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BRIEFLY TOLD.

THE RETURN TO NORMAL BUSINESS CONDITIONS AND VALUES.—Although some weeks prior to the recent election the business interests of the country generally had reached the conclusion that the voters would emphatically repudiate repudiation, it may not be gainsaid that all doubt was not at an end until the ballots were counted and the returns were tabulated. The results of the canvass show that the great majority of the people may be safely counted to uphold that which is right and to stamp out of semblance of life or force that which would attempt to thrive on false or pernicious bases. Of course, every trade and all branches of commerce felt the repression that is born of uncertainty, and that repression was at its maximum perhaps during the past summer months; and it was fortunate for the gas industry that such was the period when the outlook was darkest, since it was at hand at a time when long days and bright days were the normal conditions that environ their trade and curtail their output. Now that the outlook is brightening all round, it may not look too much like boasting over one's luck in ill times, to the disgruntlement of one's neighbor in like times, to say that probably the gas industry suffered less in proportion during the days (and nights) of depression than did any other trade or industry. The reports which we have received of output, comparing that for the months of May, June, July, August and September, 1896, with that for the corresponding months in 1895, show some very odd features. In the medium class of cities and towns, taking places where the maximum annual output does not exceed 300,000,000 cubic feet, and where the minimum output does not fall below 25,000,000 cubic feet, with an average annual output over all of 45,000,000 cubic feet, the returns are in no sense homogeneous in their revealings. For instance, during the months named, places of fairly like conditions, one East and one West, show exactly opposite results—the one disclosing a gain of 2 per cent., the other a loss of almost 6 per cent. Again, two Eastern cities, not 100 miles apart, and quite of a nature in the instance of their industrial and residential divisions show, respectively, a loss and gain about even with the Eastern and Western examples noted. The entire statistics disclose a net loss over the territory or localities averaged of not quite 4 per cent., the major portion of which loss accrued in July, August and the first half of September, the other half of the last named month, in over 60 per cent. of the places, showing a fair gain; the greatest losses occurred in places where the manufacturing trades were numerous as to establishments and diversified as to the nature of the goods produced. The verbal returns which we have obtained, respecting the output for October, and for the first week of November, indicate that the gain is general, although not marked by any abnormal spurt. On the whole, it is safe to say that the course of the industry is well started on the forward ways, and we venture the prediction here that 1897 will witness a veritable boom in the trade of the gas supplier. Turning from the actual condition of the trade, from a manufacturers' point of view, for the purpose of taking a hurried look at the financial situation of the industry, we have only to point to the marked increase in gas share values that has taken place in the last 30 days. Almost everything on the list shows a substantial increase, and not only so, but there are 20 buyers now at the

increase where only one could be found at the severely sharp declines of the midsummer season. No matter from what point of view the situation is looked over, the conclusion is inevitable that the days of renewed prosperity in the gas industry are at hand.

MR. LESTER'S BOOMERANG LAUNCHED AT THE BROOKLYN UNION COMPANY.—In our issue for August 18th last we had occasion to make some comment on a petition, brought the week before by Mr. Paul E. De Fere, to the Attorney-General of the State (Mr. T. E. Hancock), in which the latter official was asked to institute proceedings looking to the annulment of the charter of the Brooklyn Union Gas Company. This action was requested on the ground that the Company was merely a federation of seven other Companies that formerly had separate existence in the city, and that the federation was merely a plan to shut out competition in gas supply, wherefore the interests of the public in that respect were jeopardized, etc. It was also alleged that other irregularities in the formation of the Brooklyn Union Company existed, the disclosure of which would be sufficient to cause the annulling of its charter; and it was further asked that when the charter was revoked the properties formerly owned by the seven companies that participated in the merger should be returned to them. As noted at the time, the Brooklyn Union Company was represented at the hearing by Mr. Wm. H. Dykeman, and his argument in opposition to Mr. De Fere's contention was an exceedingly clever one; but we venture to say that even Mr. Dykeman was not prepared to hold that his effort would be as far reaching in its effects as it proved. Perhaps Mr. De Fere's effort had about as much to do with the ultimate findings of the Attorney General as had Mr. Dykeman's, for De Fere, in his pleadings, opened up a line of reasoning by the Attorney General that induced the latter to declare that, having found the Brooklyn Union Company to have been formed in complete conformity with the applying statutes, the charters of the several merging companies should be annulled, in that their right to transact business had been voluntarily surrendered. Whether or not Mr. De Fere's argument could be justly coupled with and as an aid to his opponent's presentation of the case, the plain fact is that Mr. Lester (Mr. De Fere's ostensible employer in the premises) through his petition, instead of weakening the Brooklyn Union Company in any legal particular, has virtually installed it upon a basis that is practically unassailable with success. The memorandum filed by the Attorney General, in our opinion, is well worth preserving on the records, and we herewith append it:

"In the matter of the petition of John C. Lester to the Attorney General, to institute proceedings to annul the charters of the Williamsburgh Gas Light Company, Fulton Municipal Gas Company, Nassau Gas Light Company, Peoples Gas Light Company, Citizens Gas Company, the Brooklyn Gas Light Company and the Brooklyn Union Gas Company.—It appears from the papers presented upon the hearing that, prior to November 1, 1895, there had been organized the eight Companies above named, and also the Flatbush Gas Company, the Kings County Gas and Illuminating Company, the Equity Gas Light Company and the Mutual Gas Light Company, for the ostensible purpose of supplying gas to the city of Brooklyn and the adjacent territory. The first seven of said Companies, through the operation of their various mains, furnished the major portion of the gas supply for the city of Brooklyn. On or about November 1, 1895, the Brooklyn Union Gas Company purchased the property and franchises of these seven Companies. The sales in question were made in accordance with the provisions of Chapter 638, Laws of 1893 (Sec. 33, Stock Corporation Law), which permits corporations of this character to convey their property, privileges and franchises to corporations engaged in business of the same general character. The formalities required by the statute were as follows: Consolidations of gas and electric light corporations organized under Article 6 of the Transportation Law, or under any general or special law of the State, are specifically permitted by statute, and the same general rule applies to all kinds of business corporations (Business Corporations Law, Sec. 8.) These statutes, however, contemplate the merging of the consolidating corporations into a single, new corporation, in place of those formerly in existence. Corporations which have transferred their property and franchises ought not to be permitted to continue the semblance of corporate life, especially when they have suspended their ordinary and lawful business beyond the time permitted by law. Actions will therefore be commenced in the name of the people to dissolve the seven Companies which have disposed of their corporate rights and property.—THEODORE HANCOCK, Attorney General."

NOTES.—The proprietors of the Kingston (Pa.) Gas Company report a very gratifying increase in business.——The Johnstown (N.Y.) Company's main system is being extended.——There is every probability that quotations for cast iron pipe will be sharply advanced between now and March 1st.

[ABSTRACT OF PROCEEDINGS.—Continued from page 729.]

TWENTY-FOURTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE PLANTERS' HOTEL, ST. LOUIS, MO., OCTOBER 27, 28 AND 29, 1896.

SECOND DAY, OCTOBER 28—MORNING SESSION.

The Association assembled for the sessions of the second day of the Convention, at 9:30 A.M., Wednesday, October 28th.

COMMITTEE ON NEXT PLACE OF MEETING.

The President appointed Messrs. W. H. White, Charles F. Prichard and Frederick H. Shelton, a committee to name the next place for meeting.

The Secretary then read messages received from several members, regretting their inability to be present at the meeting; also, the following

TELEGRAM FROM THE SECRETARY-ELECT.

NEWARK, N. J., Oct. 28, 1896.

A. B. Slater, Jr., Secy. American Gas Light Association, Planters' Hotel, St. Louis, Mo.: Please express to the Association my appreciation of, and thanks for the honor conferred upon me; also, my determination to do all in my power to advance its interests.—ALFRED E. FORSTALL.

Mr. Carter H. Page, Jr., of Philadelphia, Pa., then read his paper on

SOME EXPERIMENTS IN INTERIOR ILLUMINATION.

During the latter part of last winter I prepared a report for the annual meeting of the superintendents and agents of the United Gas Improvement Company, in which I called attention to the difference between the loss in candle power of a source of light with and without globes of various densities.

I first ascertained the percentage of loss on a 60-inch standard bar photometer, and then obtained another set of values by determining the amount of light reflected by a surface covered by a grayish felt wall paper.

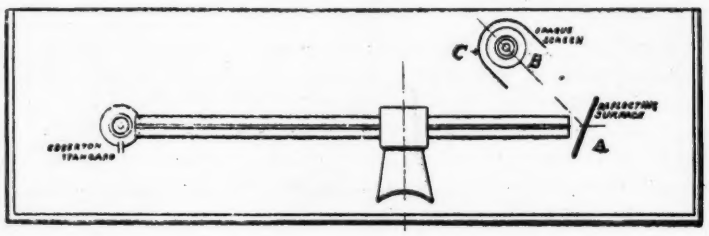

Fig. L.

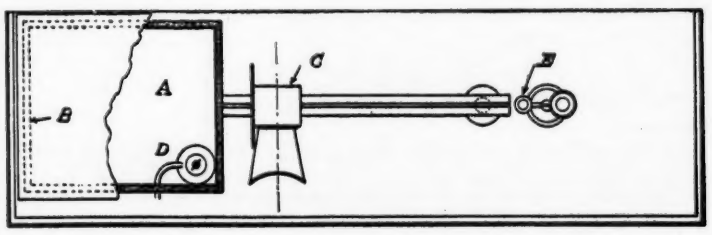

Fig. M.

Fig. L shows a plan of the arrangement of the photometer for the measurement of reflected light. The reflected surface *A* was located 30 inches from the center of the 60-inch bar, and, therefore, took the place of the source of light, which was placed at one side, at *B*.

The disc was protected from any direct rays by the screen *C*, which was carefully made non-reflecting by an even deposit of lampblack. The reflecting surface was placed at the angle 67.5° with the center line of the bar.

I was not surprised to find that the percentage of loss with and without a globe was less when measured by reflection than when measured direct; but I was surprised at the extent of the difference. Measured direct the opal showed a loss of 50 per cent.; measured by reflection this was reduced to 34 per cent.

After wasting considerable time in preliminary experiments, I finally concluded to use a photometer such as is shown in Figs. M and N in the experiments for this paper. *A* is a miniature apartment which is to be used to determine relative reflected candle power. The left hand wall *B* reflects light into the disc box *C*. *B* is illuminated by the direct

rays of light from the source *D*, as well as the reflected rays, from the sides, top and bottom, all these being covered by wall paper, as described later.

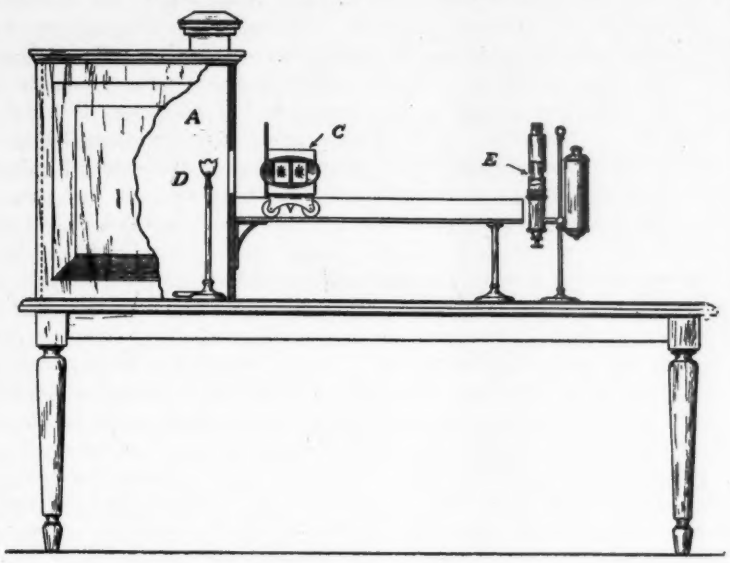

Fig. N.

The disc box was not moved in any series of trials, the adjustment being made by moving the oil standard. This of course necessitated the numeral calculation of each reading.

No effort was made to measure the consumption of gas used during the trials by the burner *D*. The direct candle power was taken at each series of trials with and without the opal standard, 4-inch squat globe, the consumption being maintained by a volumetric burner governor.

An opening in the right-hand wall of box *A* admits light from the wall B to the disc. This opening is 4 by 4½ inches, and limits the extent of the surface of *C* that is exposed to the disc. It was chiefly for this reason that adjustments were made with the standard E. The light *D* is, therefore, completely screened from the disc *C*.

I also used an absolutely opaque metal sheath over the opal globe, to determine the effect on the candle power emitted by the wall B, when all the direct rays from the source *D* were absolutely intercepted.

B is in this case entirely illuminated by the light reflected from the top, bottom and sides, due to the direct rays through the top and bottom openings of the globe and the reflected rays from the internal surface of the globe itself.

The box *A* is 30 inches high, 24 inches wide and 20 inches deep. I will consider in detail only the results obtained with a white-wall paper, unglazed, such as is used for ceilings. The relative values of different colors of paper are shown in the appendix.

Exhibit "A."

Reflecting surface dead white; marked No. 1.

(1)	Candle power direct, no globe	17.26
(2)	" " " 4-inch squat, opal globe	7.02
(3)	Loss, direct measurement	per cent. 59.3
(4)	Candle power, reflected, no globe	7.88
(5)	" " " 4-inch squat globe	6.33
(6)	Loss reflected, measurement	per cent. 19.7
(7)	Candle power reflected, opaque globe	2.82
(8)	Loss compared with (4)	per cent. 68.

Of course in the case of (7) the direct candle power would be zero; yet if measured by reflection its value is 32 per cent. of that reflected by the naked light.

Illumination involves quality of light, as well as intensity; but at the same time the color and character of the surfaces illuminated play an important part.

I can conceive that two sources of light may give equal candle power, but of different intensities; the one dazzling, and of small area, the other with much larger area, and emitting a soft, mellow radiance.

That source of light whose rays are least absorbed by the object illuminated will prove the most efficient illuminating agent. Objects thus illuminated are rendered visible solely by the light reflected from their surfaces.

The following simple experiment indicates pretty clearly that the amount of light reflected by the unglazed material used in this case does not necessarily vary with the candle power.

Using the same paper for reflected values as in Exhibit *A*, I adjusted a 2-foot E.H. lava tip to give its maximum candle power, which was equal to 10.62. I then adjusted a 7-foot tip to the same value as nearly as possible. A comparison of their reflected values shows that equal candle power with the same gas even may give different illuminating results.

Exhibit "B."

(1)	Candle power direct, 2-ft. E. H. tip	10.62
(2)	" " " 7-ft. E. H. tip	10.80
(3)	" " reflected, 2-ft. E. H. tip	3.83
(4)	" " " 7-ft. E. H. tip	4.62
(5)	Efficiency of 2-foot tip, 3.83 ÷ 10.62	per cent. 36.
(6)	Efficiency of 7 foot tip, 4.62 ÷ 10.80	per cent. 42.7

The candle power of the flame given by the 2-foot tip would, therefore, under the conditions of this test, have to be 4.62 ÷ 36, or 12.83, an increase of 2.03 candle power, to equal the reflected illuminating value of the 10.8 candle power emitted by the 7-foot tip. The flame of the 2-foot tip was "stiff," with very prominent horns; that of the 7-foot tip was smaller in size, and flabby, being just below the smoking point.

In this case the total area of the flame of the inferior illuminant was the larger; but the larger bluish center reduced the effective area below that of the 7-foot tip. In order to determine the effect with the relative areas reversed, I used two Sugg "D" Argand burners, one adjusted to give its maximum light, but safely below the smoking point, using a 6-inch chimney; the other giving the same direct candle power, but with the chimney lengthened to shorten the flame and increase the intensity. In the former case the flame was 3½ inches high; in the latter 2 inches.

Exhibit "C."

(1)	Candle power direct, 3½-inch flame	19.35
(2)	" " reflected, 3½-inch flame	9.04
(3)	" " direct, 2-inch flame	19.47
(4)	" " reflected, 2-inch flame	7.82
(5)	Efficiency of 3½-inch flame	per cent. 46.7
(6)	Efficiency of 2-inch flame	per cent. 40.3

In this case the most intense and compact flame gives inferior illuminating results as compared to the large, less intense flame with the short chimney. To equal the effect of the 3½-inch flame the 2-inch flame would have to be 9.04÷.403, or 22.43 instead of 19.36 candle power.

The reflected light in all the above readings showed no more difference in color, compared with the oil standard, than is ordinarily found when testing a 25-candle power gas against candles.

APPENDIX.

Direct Measurement. Open flame, E. H. tip; Candle power.	Direct Measurement. With opal globe; Candle power.	Direct Measurement. Loss due to globe Per cent.	Paper Used.	Reflected Measurement. Open Flame E. H. tip; Candle power.	Reflected Measurement. With opal globe; Candle power.	Reflected Measurement. Loss due to globe: Per cent.
17.26	7.02	59.3	No. 1 White.	7.88	6.33	19.7
21.94	9.38	57.2	No. 2 Cream.	9.94	7.58	23.5
21.94	9.38	57.2	No. 3 Olive.	6.46	4.84	25.0
22.30	9.56	57.1	No. 4 Mustard.	5.34	4.05	24.3
17.26	7.02	59.3	No. 5 Blue.	2.72	2.04	25.0

The reflected light in the first three cases was of nearly the same color as that from the oil lamp; so the correct adjustment of the disc was not difficult.

In the case of No. 4 and No. 5, the difference in color on the two sides of the disc made the adjustment difficult, and the reflected values as shown may be regarded as relative, rather than accurately correct.

The reflected value of No. 5 is higher than it should be, as the position of the disc had to be changed, owing to the small amount of light reflected.

Discussion.

Mr. A. C. Humphreys remarked: Mr. Page's interesting and instructive account of his experiments in reflected light should be by us heartily welcomed. It opens up from a new standpoint, at least as far as this Association is concerned, that interesting question of possible difference between candle power and illuminating effect. Papers previously presented to this Association have shown that, while there may be such a difference, this difference can be explained without impugning the reliability of the photometer. Some of these previous papers have pointed out in considerable detail that, in a great measure the difference is only apparent, and that it is often found in the use of the light source in such a way as to prevent the eye from properly appreciating its true value as an illuminant, if properly used. It is to

be noted that these experiments are all made by the use of an ordinary photometer, and that, therefore, they depend upon the truth of the law of the inverse squares. I wish Mr. Page had explained a little more in detail the various steps taken. Of course, in work of this kind, before we draw our conclusions, we must be sure that the experiments have been completely safeguarded. I think also we should all have liked to have heard from Mr. Page his interpretation of these experiments. Perhaps the discussion may develop this point. As to the details of the experiments, I note that an oil lamp was used as a standard. The reason for using a portable standard was valid. I think it would be well, though, if Mr. Page would explain what steps were taken to ensure the uniformity of standard over the time occupied by performance of the several experiments. Was it constantly restaudardized? The gas was not measured, but uniformity of flow was maintained (or such was the aim) by use of a volumetric burner governor. Would it not have been well to have also measured the gas consumed? But all the experiments seem to point to a difference in value of light sources after the light therefrom has been reflected, which before reflection were of equal value. Here we must at once bear in mind that light which is reflected is necessarily changed as to *quantity and quality*. This is clearly pointed out by Mr. Page when he says, "That source of light whose rays are least absorbed by the object illuminated will prove the most efficient illuminating agent." But how can we make this selection in advance? If the predominating tint of a room is red, the light which has the greater proportion of red rays will be the most efficient. If the predominating tint is blue, then it will be most economical if we have less of the red rays and more of the blue. If we had a light source which gave a light of such composition as to combine as a true white light, and we had a reflecting surface which was absolutely white, we would have the reflected light also white—that is, its composition would be unaltered; but such conditions are never obtained in artificial illumination. Therefore, we cannot expect, if a comparison is made in reflected illumination between a light shaded and a naked light, or between two naked lights, which are primarily of different composition due to difference in adjustment as to combustion, that we will find the reflected values equal simply because they were equal before reflection. It would be very remarkable if we did find such equality after reflection. Let us now consider the cases covered by Exhibits B and C. Here we have two flames in each case adjusted so as to give great difference in quality of light. In one case a larger quantity of gas is burned and the combustible adjusted so as to give a smaller and more intense (effective) flame area. In the other case the gas is consumed more economically, the flame area (effective) is greater and less intense. Of course, while the candle powers of the two lights are made equal, the composition of the light from the two sources is widely different, and, therefore, the influence thereon of *any* reflecting surface must be different. In passing, it is worthy of particular notice from a practical standpoint that, in the case of the flat flame burners, the total area of the flame from the 2-foot E. H. tip was larger than that from the 7-foot tip, but the *effective* area of the former was smaller than that of the latter. This is a point which has often been lost sight of in discussions upon this and allied subjects, and especially in discussions as to relative efficiencies of high and low candle power gases. The 2-foot flame, burning its gas under excessive pressure, giving a flame whose total area was larger than that of the 7-foot burner burning its gas under lower pressure, can fairly be considered as representing the low candle power gas. While the flame is larger, the *light source proper* is smaller. Also, the light source proper of the larger flame is more intense than the light source proper of the smaller flame. Just the opposite of this is usually claimed by the advocates of low candle power gas. Mr. Page states that the reflected light in all the readings tabulated in Exhibits B and C showed no more difference of color, as compared with the oil standard, than is ordinarily found when testing a 25-candle power gas against candles. This may be true, but his experiments show that if the color composition of the lights in each case before and after reflection had been accurately determined, a decided difference in composition would have been found between the two lights before reflection, and after reflection the composition in each case would have been found materially changed, and the change in each light would have been quite different, and this must be so though the reflecting surface is a so-called white paper. If the last three paragraphs refer to the appendix, then, in considering the effect of reflecting surfaces of different colors, we must bear in mind that experiments 4 and 5 were found by Mr. Page to be not entirely reliable. Referring to the change in color composition of a light, through absorption by reflecting surfaces, it is to be remembered that if, owing to differences between the composition of the two lights, a difference of effect is obtained as to the two lights, this difference, through absorption, will be multiplied by the *repeated* reflections which would be especially found in the case of such a small chamber as the one used in these experiments. Now, let me for a moment consider the experiments recorded in Exhibit A. We find by direct measurement the loss in candle power due to tne obstructive effect of the opal globe is 59.3 per cent.; but when this comparison is made with the reflected light the loss is shown as only 19.7 per cent. But is this a complete comparison? In the first case *all* the rays for the second measurement pass through the opal globe, but in the case of reflected light part of the rays are so obstructed and part are not, but pass unchanged through the top and bottom of the globe, and this light finally reaches the disc just as much as if it had passed from the naked flame. Also, in addition, a certain amount of light (which first does meet the opal globe's inner surface and is reflected out and through the top and bottom), is reflected to the disc. In the first case, direct measurement, neither the light which passes out direct through the bottom and top reaches the disc, nor does that part of the light which is reflected out therefrom. In other words, in the first case we test a *sample* of the light, *all* of which sample we pass through the globe; and in the second case we try to measure *all* the unobstructed light against *all* the obstructed light, but the experiment fails to obstruct a material part of the light last so measused. To make the comparison a fair one, *as far as this one element is concerned*, the globe, in the case of reflected measurement, should be a complete globe, which, of course, is hardly practicable. But Mr. Page has himself made an experiment which he records in Exhibit A, line 7, and which helps to clear up this point. Whether he made it for this purpose I am unable to determine from the text. He uses the experiment to point out that even in the case of an opaque globe, reflected measurement, there still remains 32 per cent. of the reflected light from a naked flame, though if measured direct there would be no light therefrom. Of course, Mr. Page cannot mean this as indicating that the *quality* of the light is changed, but only that when we state the loss in candle power from various obstructive appliances we must bear in mind that the obstruction only affects that part of the light which actually comes in contact with the obstruction. The experiment, simple as it is, is very valuable in pointing out differences between results given in the photometer room and the results to be obtained in practice. The case is analogous to some of those I have before now drawn to your attention, as for instance, the difference between the candle power of an arc light as measured along the line of maximum effect, and the candle power as measured along other lines. Here the true candle power can only be found by averaging the readings at all angles and in all azimuths. The same point is to be observed in a minor degree in the cases of flat gas flames, oil lamp flames, electric incandescent, etc. This simply points to what should be obvious, namely, that *photometric observations should be interpreted carefully and intelligently*. Bearing in mind experiment No. 7, should we not correct the result recorded in No. 6? I will presume that the metal sheath or opaque globe used in No. 7 was carefully blackened, as in the original experiment in direct reflection (see Fig. L). If so, the light reflected through top and bottom in case of the opal globe would be practically the same as in case of the opal globe enclosed in metal sheath. The candle power reflected, opal globe, was 6.33; but this included the light which passed direct through top and bottom, and also what was reflected by the interior surface of globe therefrom, which by No. 7 we find to be 2.82 candle power. Therefore, the reflected candle power of that part of the light which was actually obstructed by the globe was 6.33—2.82=3.51. The candle power reflected, without globe, was 7.88; but this includes the light which, in case of the globe measurement, passed out at top and bottom. For comparison, then, this quantity should be here also deducted. But from the experiments we only know this quantity, taken together with the light reflected out from the globe. It is probable this amount is but small. If we neglect this correction and deduct 2.82 we have then, 7.88—2.82=5.06. The loss in candle power is, as before, 1.55, but the *percentage* of loss is 28.6 per cent. instead of 19.7. This calculation cannot be quite correct, because we do find the same loss in candle power when all the light considered is supposed to be obstructed, and when part of the light is considered as unobstructed. If we apply the same method of analysis to the results given in the appendix, we find the percentage of loss in the case of reflected light considerably changed. For instance, in case No. 3, the loss due to globe, reflected measurement, olive paper, is 25 per cent. If we deduct 2.82, respectively, from 6.46 and 4.84, we have the corrected values 3.64 and 2.02, and the difference 1.62, being a loss of 44½ per cent. instead of only 25 per cent. I would again like to express my keen appreciation of Mr. Page's work. I think, though, it should be continued and every precaution

then taken to check up results and to explain them. I hope that he will be persuaded to continue his investigations along this line, and that at some future meeting he will give us the benefit of this additional work.

Mr. Greenough then took up the discussion by saying that in the written argument submitted by Mr. Humphreys, the latter appreciated what people, who have inclined to the belief that the photometer is not an infallible instrument in determining illuminating power, would say on reading Mr. Page's paper. Mr. Humphreys asks us, too, to consider in the case of the use of a 2-foot burner, certain differences in illuminating power arising from the conditions of tenacity, and shape of flame, etc. Mr. Page, however, ascribes the differences to causes that are quite in discord with those suggested by Mr. Humphreys.

Mr. Harper—I am sure we all very fully appreciate the trouble Mr. Page has gone through in the preparation of this paper. It bears on a very important phase of our business—the attainment of the highest lighting efficiency. As Mr. Cleveland would say, "We are face to face with a condition and not a theory," as the internal illumination of to-day is largely a struggle between the aesthetic and utilitarian; and if our consumers will persist in using an infinite variety of colored shades, wall papers and internal decorations generally that are destructive of light, Mr. Page's research will enable us to speak with some authority in regard to the relative loss of light incurred. In the eighth paragraph of his paper, Mr. Page says, "The direct candle power was taken at each series of trials with and without the opal standard, 4-inch, squat globe." Judging from the position of the source of light D, in the plan and elevation of the photometer shown at Figs. M. and N, I presume these direct measurements were taken on an ordinary 60-inch bar. If this is correct, then, presumably, the tests were made with the flat side of the flame toward the disc box. Now, while it is true that by this method of measurement we obtain the relative "lighting value," would the value obtained with the globe on remain constant throughout an entire rotation of the light source? In other words, would the value be the same at any point on the circumference of the globe at right angles to the plane of the light, irrespective of the position of the light in its interior, keeping in mind the reflection from that interior? To put it still another way, "What would be the value, measured direct and with the globe on, if the interior back part of the globe were covered with some non-reflecting substance?" Assuming the value to be less than that given by Mr. Page, does the method of measurement adopted by him give a fair criterion of the value, under specified conditions in ordinary internal illumination? In the methods employed by Mr. Page for the measurement of reflected light it seems to me the results obtained can be at best only rough approximations to the truth. The light from D will be reflected simultaneously by the top, bottom, sides and back of box A; but those rays only, the angle of reflection of which coincide with the aperture opposite disc box, will be effective on the disc. Here, again, we have a somewhat abnormal condition which, in my judgment, does not give a fair valuation of reflecting surfaces in general internal illumination. Mr. Page himself shows that, with the direct rays from D completely shut off, he still got a value of nearly 3 per cent. by reflection from top and bottom apertures of globe. Again, are we justified in speaking of a "standard, 4-inch, squat globe?" Have we such a standard? Are the globes as designated and selected for this test so uniform in thickness and capacity that they can be used as a standard to which all other opal globes can be relegated; and is it not true that the refrangibility of the light rays will be affected in proportion to the thickness and opacity of the intervening medium, whether the opacity be inherent in the medium or caused by some special preparation of its surface? About 36 years ago Mr. King, in England, and Mr. Storer, in this country, made some very important experiments regarding the amount of light cut off by glass of varying degrees of thickness, opacity and color. Mr. King's results were as follows:

Clear glass.....	10.57 per cent.	Smooth opal...	52.83 per cent.
Ground glass ..	29.48 "	Ground opal...	55.85 "

No thicknesses of glass are given in these experiments, but you will notice a figure is given for the opals not very far removed from that of Mr. Page. Of a great number of tests made by Mr. Storer I select four:

Crystal plate.....	⅛ inch	8.61 per cent.
English crown	⅛ "	13.08 "
Double English window	⅛ "	9.39 "
Double German	⅛ "	13.00 "

Between the highest and lowest of this series, with the same thickness of glass, there is a difference of 52 per cent., showing the importance of the constitution and general condition of the intercepting medium through which light is to be measured. Mr. Storer shows that ground glass gives a value apparently independent of thickness—that is, that the values will closely approximate, whether single or double glass be employed. The same may be said of smooth and ground opal. I am of opinion that if Mr. Page's researches were carried far enough to embrace a fairly representative number of the great variety of opal and colored globes so extensively used, as well as a number of samples of wall papers of reflective and absorptive tints as commonly used, considerable good would result. While it is commonly known that certain colored globes and wall papers destroy or absorb a large amount of light, the varying degree of absorption is largely conjectural. I think, therefore, that if such valuable information as Mr. Page has given us were extended and grouped together in some convenient form we would all find many occasions on which such knowledge could be made to tell with good effect.

Mr. Norris—As a general proposition it is safe, when some apparent error shows persistent vitality, to assume that underneath the error there is a substratum of truth. The "Candle Power versus Illumination" problem is one that has been agitating the minds of gas men for years, and the ghost refuses to be laid. Now what is the underlying truth that gives to this controversy its power to live? The eye sees objects by virtue of the light reflected from them, and it is this reflected light that is a measure of illumination. The photometer does not measure this reflective value of lights, but only the intensity of their direct rays, and thus it is that lights of equal candle power but different quality are not of equal illuminating value. Now it so happens that what a man wants when he buys a light is illumination. He does not care for the candle power of the source of light—what he wants is to see the things in his house, and just here is where the photometer is weak. Let us assume an extreme case as an illustration. Suppose we have two light sources, one emitting an absolutely pure blue light, the other an absolutely pure red light. I presume it would be possible to compare these two lights on a Bunsen bar photometer, and adjust them so as to give equal candle powers. Now take the red light into a room in which all the furnishings are of a pure red color. The room would be a peculiar one, but it would appear quite well illuminated. Now remove the red light and substitute the blue one, and note the result. The walls, the floor, the furniture, all would be in absolute darkness, and the only thing visible would be the blue source of light. Here we have two lights of equal candle power, as shown—and truly shown—by the photometer, but which, under the conditions assumed, are of entirely different values for illumination. Now combine the two lights, and we have a purple source of double the candle power of either alone. Take this combined purple light into the same red room, and the illumination would be exactly the same as when the red source was used alone. In this case we have two lights, one of twice the candle power of the other, and yet each having the same illuminating value, showing that the illuminating value of lights depends upon the conditions under which they are to be used, while the candle power is an absolute quantity that would be the same though the light were shining alone in empty space. True, the conditions I have assumed are impossible in practice, but the difference is one of degree and not of kind. Lights emit rays made up of different proportions of the cardinal colors, and the objects upon which the rays fall select only some of these rays for reflection, the color of the object as seen by the eye depending upon this selective reflection. A light source sending out red and blue rays in equal quantity would show a white object as purple, for the white object would reflect both the red and the blue rays; but let these rays fall on a body that only reflects red rays and the body would appear red, the blue rays being completely absorbed. So far I have spoken only of the rays that proceed from the light source and are reflected directly to the eye of the observer. But the reflection of these direct rays is not the complete measure of the illumination of a room. Each little point of the objects upon which the direct rays fall becomes in turn a light source and helps illuminate its neighbors. Thus, the light falling upon any object in a room may be divided into two parts—one the primary illumination of the direct rays from the source of light, and the other the secondary illumination of the reflected rays from the neighboring lighted objects. Here again it is evident that the phenomenon of selective reflection plays an important part in illumination. If the object in question is in "color sympathy" with the source of light it will appear well lighted by the direct rays, while the amount of secondary illumination will depend upon the color sympathy of the source of light of the object in question, and of the general furnishings of the room. The reflection—or, shall we call it radiation?—back and forth of the light from point to point, of rays coming originally from a light

source, constitute what is known as diffused or scattered light. Some one has said that a large proportion of the disagreements between intelligent men come from looseness of definition and the use of the same term to express different ideas in different places This certainly applies to the expression "diffusion," or "diffusive power" of light. Years ago Mr. A. C. Humphreys showed, by a series of experiments that amounted to a demonstration that, with the lights he used, there was no difference in their "diffusive" or penetrative power, taking "diffusive" power to mean the ability of the light to penetrate space. But these experiments did not attempt to compare the various light sources from the standpoint of "diffusive power," if we take diffusive power as being measured by the amount of scattered light to which they give rise. Mr. Humphreys' paper was a successful effort to show that, where light sources of equal candle power differ in effect, the difference is not in their penetrative power; but this proof has often been regarded as a denial of the very apparent fact that, with lights of equal candle power but of different quality, there may be a large difference in the proportion of secondary illumination, due to the scattered light.

Mr. A. S. Miller thought it would have been better had Mr. Page made all his experiments according to his original plan, for when he abandoned the disc of given size, substituting therefor a room, the conditions were so different that it would be virtually impracticable to satisfactorily carry out the comparisons or to arrive at an acceptable finality.

Mr. Thompson thought Mr. Page had put the members under obligations for what he had read to them, for his paper showed that the author had put much time and thought on it, as anyone who had gone into photometric experiments, on even a small scale, could not help but admit.

Mr. Rusby thought the experiments made by Mr. Page were extremely interesting, and that the author had opened up to the members a field for investigation that was most fertile in promise of good results.

The Secretary then read the following contribution to the discussion, forwarded by Mr. A. B. Beadle, of Philadelphia: The paper under discussion suggests that our efforts in the field of artificial illumination have so far been mostly in the direction of producing intense local sources of light. Is not our illumination by gas, and electric light, too, artificial and unnatural? The human eye is not a good photometer, except where it is asked to judge of the effect produced by diffused and reflected light. The normal eye, by the development and training of thousands of years, is adapted to do its best work by daylight—that is, by the light of the sun. But this source of light is so far away, and is generally at such a height above the usual plane of vision, that the eye seldom looks at it directly. Our experience of daylight, then, is almost always under a condition of diffusion and reflection. Daylight enters our room by large windows, and is reflected from the ceiling and from wall to wall until it is thoroughly diffused and softened. When we are out of doors we do not look directly at the sun, for we know that the eye would be dazzled, and for a time we would not be able to see things distinctly. But when the sun has set and we light our gas or electric lights it is another story. After the first glow of pride and satisfaction at the thought of the wonderful conquest of mind over recalcitrant matter, we generally find that our eyes are getting somewhat uneasy and tired. What is the trouble? Why, we are doing at night exactly what we instinctively avoid doing in the daytime—we are looking straight at a lot of little suns that we have stuck up all about our rooms and streets. In 1891 I made a rough experiment that will illustrate the point I want to make. I noticed that one member of my family had a habit, during the evening, of holding a fan or paper in front of the face, so as to cut off the direct light coming from above the center table. The explanation always given was that the direct rays of light produced an unpleasant feeling in the eyes. In this case the eyes were normal in every respect. I then improvised an opaque reflector under the source of light, so constructed that all the light was reflected to the white ceiling, covering practically the whole ceiling to its juncture with the walls. Under these conditions the room was illuminated only by the reflected light thrown down from the entire ceiling. The effect produced was highly satisfactory. In comparing this effect with that previously obtained, one might say, at first, that the room was more brilliantly illuminated by the direct rays; but after a few minutes' experience of the illumination by reflection alone, the verdict would be that the latter was far better. While less intense and local, the illumination was an approach to the effect produced by daylight. Faces and objects about the room could be seen more distinctly, and the uneasy, uncomfortable feeling about the eyes was no longer in evidence. For the general illumination of the room this reflected light was entirely satisfactory. In this case a well-shaded drop light was also used for reading or writing. Probably the center lights could have been increased sufficiently to allow of reading or writing in any part of the room, thus making the drop light unnecessary. Some one will say that it would take more gas to produce this result. Perhaps it would, but this method of lighting would be a rational and natural one, and well worth any slight increase in cost, which, by-the-way, we should probably offset by the saving in oculist's bills. It certainly is our duty to show our consumers how to get the most satisfactory lighting effects. I often notice two large stores in Philadelphia that represent distinctive types of illumination. In the windows of the first the source of light is above, and is entirely concealed from the eyes of one looking into the window. The effect produced is particularly soft and pleasing. Colors and contrasts of light and shade come out beautifully. The window of the other store is studded with naked incandescent lights, from top to bottom. The result is that the eyes are dazzled by the brilliancy, and the display of goods is not seen to advantage. After looking in for a few minutes the eyes feel very much as they would if one had been looking directly at the sun. In the latter store windows the lighting probably costs three times as much as in the former, but the effect is particularly inartistic and bad. While in many cases it is not practicable to use reflected light alone, I think the results of Mr. Page's experiments should encourage us to *conceal the source of light as much as possible.* I believe this is the secret of artistic interior illumination. Note the popularity of the modern, high candle power oil lamp, as now equipped with gorgeous shades. In many cases they have become a fashionable fad, one result of which is that we miss the privileges of starting up many a bench or set of water gas apparatus. The cause of this popularity of the oil lamp is the soft, artistic effect produced, and this is due to the fact that the elaborate shades conceal the direct rays from the eye. I am afraid the average gas man is leaving undeveloped a very important branch of his profession. He should be more than a gas engineer; he should be a lighting engineer. He should be looked up to in his local community as an authority on effective and artistic illumination. Certainly, in the smaller towns, he should always be open to consultation about the proper arrangement of lights for various purposes; and no banquet or formal dinner should take place that does not evidence his skill, even if he has to furnish the gas and the fixtures. The gas man has followed to literally the scriptural injunction that his light should not be hidden under a bushel. The time has come when he can win more consumers, and incidentally increase his output, by hiding his light under an artistic shade, reflector, or partially opaque globe. I firmly believe the day will come when the presence in our rooms of a naked gas or electric light, or one that is only partially softened by a glass globe, will be looked upon as a relic of an obsolete barbarism.

The President in asking Mr. Page to close the discussion, remarked that the author must know they all appreciated the time and trouble necessarily involved in the preparation of a paper like the one Mr. Page had submitted. He (the President) also called attention to the heading of the paper, which declared that it was a recital of "Some Experiments;" and did not at all pretend to exhaust the subject. He thought the paper would lead to more extended investigations on similar lines by others in the near future.

Mr. Page in closing the debate replied to the various questions propounded. Referring to Mr. A. C. Humphrey's question anent the oil lamp standard, he said he employed a student lamp, with a wick so adjusted at the base that it could be raised or lowered independently of the slot chimney. He had kept that lamp at work in a trial lasting six weeks, and it satisfied him in every respect. His reference to the standard, squat globe had more to do with dimensions rather than thickness, for types of squat globes differed in that some flared, whereas others were rounding. His standard in that respect was globe-shaped.

On motion of Mr. A. C. Humphreys a vote of thanks was passed to Mr. Page for his able, instructive and suggestive paper.

[To be Continued.]

The Incandescent Fire Mantel.

[A paper read by Mr. T. E. Pye, of London, before the Midland Association of Gas Engineers.]

The incandescent fire mantel is an appliance designed to facilitate the combustion of non-bituminous fuel in the ordinary domestic fire-grate, and thereby to secure a fire of pleasing appearance and thorough efficiency, which shall at the same time emit neither smoke, smell nor

any objectionable fumes whatever. Wood of all kinds, bituminous coal of the best or of the poorest descriptions, anthracite coal or gas-works coke, will all burn with facility and intensity in any ordinary grate fitted with the fire mantel, whilst the addition of a limited percentage of so called non-combustible material, such as spent oil shale, cannel coke, etc. (say from 15 per cent. to 20 per cent.), will not materially deaden or even affect the fire.

Of all the fuels just mentioned, there is no doubt that, in view of the claims made on behalf of the new appliance—viz., a smokeless fire which is maintained at about half the expense of an ordinary coal fire, gas works coke is the best suited for use under the system, and a varied experience of this residual, as employed in conjunction with the mantel, has clearly demonstrated its utility for all ordinary purposes of domestic heating.

It is not claimed in connection with the appliance that in the domestic grate we find an actually new field for gas works coke; and further, it is admitted that in some few instances this fuel has been successfully employed by gas engineers and other technical men in domestic warming without an admixture of coal or other artificial aids to combustion. It will, however, on the other hand, be readily admitted that if the said field be an old one it certainly has, as yet, been but little worked upon, and that for all practical purposes gas works coke used alone is, as a popular domestic fuel, a conspicuous and certain failure.

That if burned under conditions suited to its proper and complete combustion gas works coke would prove an ideal fuel for such purposes has long been known by the most eminent authorities. Professor Ramsay recently pronounced most strongly in favor of the general use of coke. Speaking upon the smoke nuisance, he said: "There is one material—viz., coke, which gives out, weight for weight, a greater amount of heat than coal, which emits no smoke, and which produces what all of us are so unwilling to relinquish—a bright glow in the grate. In Paris it is the universal fuel. Could we induce our dense population to adopt coke fires our smoke nuisance would be greatly abated. Paris is a larger city than Glasgow, and yet it is clean and bright, while Glasgow is dark and dirty. The difference is almost entirely due to the fuel burned."

With this introduction I have much pleasure in bringing under your notice the incandescent fire mantel, believing, as I do, that providing what has for so long been required for the proper combustion of the coke, it is destined to do yeoman service for many a perplexed gas manager in assisting him in the profitable disposal of what for so long has been a positive drug on the market.

It is quite unnecessary to take up time at a meeting of this nature in arguing the importance of the considerations arising from what is practically the development of a new industry, and which, if one-half of the anticipations of the promoters of the system be realized, will almost revolutionize the present condition of coke sales. You will also readily anticipate most of what I may say upon the chemical actions attendant upon the use of the appliance, and I propose, therefore, to ask attention for the present more particularly to such practical issues as have already been decided, and to present data of actual experiences.

The fire mantel is, as you see, a simple contrivance, consisting of a frame carrying two rows of air tubes. The frame is placed inside, and close up to, the front bar of the fire grate. When the fire is in operation these tubes convey into the interior, at two different levels, a supplementary supply of atmospheric oxygen. The carbonic oxide produced in the fire is thus met, as generated, by what may be termed the secondary air, the heat attending its conversion to the dioxide being utilized in raising to incandescence all the fuel in the immediate vicinity of the monoxide flame. By this means a large amount of heat is obtained from the incandescent material for useful radiation into the apartment which under ordinary circumstances is in great part or wholly lost, as the well-known carbonic oxide flame, usually noted in considerable amount at the top of an ordinary coke fire, although an intensely hot one, gives out no sensible heat by radiation, and its useful heating effect is actually nil. The place and action of the tubes should not be misunderstood. It is not claimed that the air currents toward the fire are concentrated on the tubes, nor yet that the tubes themselves directly increase the air supply. They do so, however, indirectly, as will be shown presently. What the tubes actually do is to convey a portion of the air, while still containing its complement of pure oxygen, right into the heart of the fire, whereas the bulk of what oxygen enters the fire through the front, in the ordinary way, is quickly converted into monoxide and dioxide of carbon. Herein lies the secret of the brilliant combustion beyond the tubes, at a point which, without them, and especially in a small fire, presents an area of most incomplete combustion and half-black fuel. The intense heat thus set up and diffused in every direction maintains a sharp, upward current of air, which serves a twofold purpose. The heated products of combustion, supplemented by a large volume of rarefied air, and minus the usual complements of smoke and dust and other clogging and weighty matter, possess a buoyancy which, so far as present experience goes, has invariably succeeded in overcoming the worst down-draughts in the ordinary chimney, whilst, as already explained, the CO produced in the fire is already largely or wholly converted into CO_2; and the only remaining fumes to be noticed, due to the sulphur in the coke, are thoroughly ærated in the fire and wholly carried up the chimney, and not the faintest trace can be detected in the apartment. Another very important effect of the rarefied air currents is the suction induced at every point of the fire, drawing fresh supplies of air, and maintaining in the apartment a free and healthy circulation, which insures a constant renewal of the atmosphere and the removal of deleterious gases.

With reference to the cost of the fire, my own experience, at home in the sitting room and in the Company's show rooms, shows a consumption of coke costing at present about 3 cents per day, which will not exceed 4 cents in the winter time. Coke is sold in London by measure, but I believe present prices range from $3 87 to $4 per ton, inclusive. From this data you will readily calculate the relative cost of the fire in any locality. You will probably have already seen the figures given in this connection by Mr. Geo. Lane, of Aylesbury, which are as follows: "For 12 hours' consumption of coke it cost, at 8 cents per bushel, 4 cents to heat a room 15 feet by 18 feet, maintaining a temperature of 65° F."

The manipulation of the appliance is as follows: Having filled in the bottom row of tubes the mantel is placed in position just inside the fire bars, and the fire laid in the usual way with paper, wood and coal. The top row of tubes is then inserted and the fire is lighted. When the coals are well alight coke is added, and is then used alone for the rest of the day. Where upright Bunsen gas burners are available they will provide a ready means of starting the fire without the use of coal.

In conclusion, the claims here put forward of a satisfactory solution of the long-standing difficulty in the way of a universal adoption of coke for domestic heating—large and important as these claims may be and are—are daily being supported by highly respected members of your own profession, whose names are a guarantee of their disinterestedness—except as regards the profitable disposal of the residuals of their undertakings. Mr. F. Livesey, of the South Metropolitan Gas Company, long ago reported most favorably on the utility of the appliance, and I am informed that his staff now recommend it to consumers. The Gas Light and Coke Company tested it under lengthened and severe trials, using two fires side by side, with and without the mantel, with most satisfactory results. And amongst other engineers well-known to us all, Mr. W. Hardie, of Newcastle-on-Tyne, after repeated trials, expressed his complete satisfaction, and desired the Incandescent Fire Mantel Company to publish, on the circulars for that district, the recommendation of his Company. I would much prefer, however, to spare you details of this nature, but—having myself had a lengthened experience of gas management in London and the provinces—I fully appreciate the importance to the industry of the new system, if only the claims made on its behalf can be substantiated. That this is so the independent testimony referred to can leave no doubt; and this testimony is being supplemented almost every day. What will, however, interest you even more is the following. Owing to my connection with the Incandescent Fire Mantel Company I am able to say that the appliance is being received most enthusiastically by the general public in all parts of the country, and that its operation and utility are more thoroughly understood and appreciated than could have been expected for an appliance so new and original. As it becomes better known so the demand increases, and to such an extent as for the moment to seriously embarrass the management in the prompt execution of orders, as probably some gentlemen in this room are aware. The home demand for gas works coke must, therefore, follow; and if gas engineers will make known to the consumers the unique advantages of the fuel, the new possibilities of using it without unpleasantness and difficulty, and the facilities they have for delivering it at a moderate cost of the consumer's own door, broken ready for use, I am convinced that those of the members who hitherto have had but a poor demand will very soon reap profitable fruits from their new enterprise, which will go a long way to recoup losses on the ever-dwindling values of the other residuals, more particularly sulphate of ammonia.

Discussion.

The President said they were much obliged to Mr. Pye for his interesting paper, and for showing them this novelty. The coke fire in the room was fitted with one of the mantels, and he thought they would all agree that the fuel was being consumed in a very different manner to what it would be in an ordinary grate and under ordinary circumstances. Anything that would help them to get rid of the heaps of coke in their works would be a great boon to gas managers; but then the question arose whether that would not interfere with the consumption of gas in gas fires. They would be glad to hear what any one had to say about this new method of burning coke.

Mr. J. F. Bell, Stafford, said that anything that would enable the domestic consumption of coke to be increased would be a great boon to gas managers. One point that occurred to him was whether the air tubes would not quickly burn out. The fire in the room was certainly better than it would be without the apparatus, and if the company would let them have these mantels, and guarantee that they would last a reasonable time, he thought they would be a great advantage. Nothing could be better than a coke fire for heating kitchens and other apartments that were regularly used. Of course, for rooms that were only occasionally used no one would think of introducing anything but gas fires.

Mr. H. Taplay, Wellington, referring to the need for regulating fires in accordance with the varying temperatures throughout the day, asked how it was proposed to regulate the coke fire, if it was to last the whole day long. If the fire was to be built up in the way proposed the heat would be at times intolerable. A gas fire they could moderate and a coal fire they could moderate, but he could not see how they were to moderate the heat with one of these things, unless they pulled the whole paraphernalia out.

Mr. C. Meiklejohn said there had been one of these fires in his Board room for some time, and he had a little experience which answered Mr. Taplay's question to some extent. He did not see how a coke fire could present any greater difficulty in the matter of the regulation of the heat than a coal fire did. When they wanted to reduce the power of a coal fire they stopped putting coal on, and the same applied to the coke fire. When they ceased putting coke on the fire burned gradually down. The fire in his Board room was lighted at 6:30 and it was still alight after 9 o'clock. There was no coke put on in the interval, and, of course, the volume of heat was greatly reduced. He understood from Mr. Pye that the small bit of fuel left at the end of the period referred to was sufficient to start the fire again without the addition of anything else. Therefore, he saw no difficulty about increasing or decreasing the heat at will. He fully endorsed all Mr. Bell had said about the value of a domestic demand for coke, and also what the President had said with regard to the increased brilliancy produced when the mantel was used; but he was not satisfied that the mantel made it possible to burn coke in any grate. He had tried the smallest size mantel in the grate in his own office, and he had had to discard it in favor of a gas fire. The grate was a very bad one, as no depth of fuel could be put into it; and with the mantel on the temperature did not rise above 55° on a not very cold day.

Mr. Taplay said he did not wish to be understood as being against coke fires. What he wanted to know was whether, in a domestic room where the family would be sitting—and, generally, they sat round the fire—whether there was any means of regulating the heat, such as they had in the case of a coal fire.

Mr. S. Meunier, Stockport, said his experience of the mantel only dated from the previous day, although he had given an order some 12 months ago. He had one fixed, but it had not been in use above an hour when one or two of the tubes had split. He should like to know what Mr. Pye's experience had been with the tubes. The disposal of coke was, with him at any rate, a rather important subject. He was in the beautiful position of having many gas works around him, where there was a great deal of coke produced, and consequently there was considerable difficulty in getting rid of it. Any increase in the sale of coke would benefit their balance-sheet; but he was not quite sure whether it would be the best thing for the purpose. Undoubtedly it would have a good effect with regard to fogs, but it might be that if they endeavored to increase their output of coke it would reduce the price of coal. Their great difficulty was due to the fact that coke had to be sold too cheaply. It might be that by improving the demand they would simply be reducing the price of coal, and not improving their revenue. His idea was that it would be better for them to try and get rid of their coke by the ordinary means, and endeavor to increase their trade in gas fires. Mr. Pye was speaking from experience gained in the south, but experience down south and experience up north were different in more ways than one.

Mr. C. E. Jones, Chesterfield, wished to speak as a user of coke for domestic and other purposes for a quarter of a century. It had been said that God made the country and that man made the town, and that was no doubt so. Man had made the towns, and he had made some of them very ugly and some of them very beautiful. But directly he put up a nice building he dressed it in a suit of semi-mourning. The crusade against smoke was a very justifiable one. The coke fire was smokeless, and gave more heat and was more manageable than the coal fire but they had to convince the intelligent British public that that was so, especially in the neighborhood of the coal fields. People liked to see a flame, and could not understand that a good fire could be obtained without flame. He contended, from an experience extending over a quarter of a century, that the coke fire could be controlled without any such appliance as was before them, and with equal success. The chemical reasons given by Mr. Pye to explain the action of the mantel appeared to him to be insufficient, because the same result was obtained in a well-regulated coke fire without any tubes at all. If by leading air into the center the combustion was accelerated it would lead to an increased consumption of fuel, which was said not to be the case. The secret of coke fires lay in the breaking of the coke to the proper size. If they broke their coke, according to the sizes of their grates, from the size of a walnut up to the size of their fist, or took it even as it came from the gas works, they could obtain a good fire without smoke; they would obtain more heat, and a little practice would enable them to light the coke with only a little wood. All the fires in his house were coke fires, and they were lighted with small pieces of wood and some nice, dry, small coke. They burned up much quicker than coal fires. He had not bought a ton of coal for domestic purposes for 20 years. He had used some for greenhouse purposes, but now he used very small coke for that purpose. He was sure that results equal to those given by this mantel could be obtained by breaking coke to sizes to suit the grates. He did not think there was much in the suggestion that cheap coke would cheapen coal. In his opinion coal was too cheap now. He advised them to teach the public how to use coke fires, and thus do away with the abominable smoke which polluted the atmosphere, poisoned mankind and shortened human life.

Mr. Pye, in replying to the discussion, said he was pleased to hear that Mr. Jones had successfully used coke in ordinary grates. But the public were not like him; they were not nearly so well enlightened, and they would not take the trouble when they were enlightened. Coke was a fuel that required special care, and therefore they would need either to prepare it for the public or give them some appliance which would enable them to burn it without that special care. They would not exercise care themselves, but if they were given an appliance they would pay for it. This coke fire was as manageable as a coal fire, but an ordinary coke fire in the hands of the general public was not so. An ordinary coke fire, unless kept in full blast, would go out, and it also gave off most objectionable fumes. It had been suggested that the public wanted flame, and that they wanted to poke the fire. That was quite true, but the best way to overcome that prejudice was to show them this flameless fire at work. He had never heard the objection raised after the fire had been seen. Mr. Jones said that the chemical reasons were not sufficient; he said that an open fireplace would supply all the air that was necessary. But experience did not bear that out, for with this mantel a slow combustion or a close-bottomed grate would give as good results as the open grate did. Mr. Meiklejohn had answered the question respecting the regulation of the heat. It was a very simple matter to regulate the fire, for by means of a close fender they could convert the grate into a slow-combustion grate. He was speaking from personal experience in his own house, where, of course, it was necessary to regulate the fire, and it was done with the greatest ease. With regard to the life of the tubes his experience was that they never broke once they were in the fireplace. They sometimes broke before being placed in position. They stood the fire very well, and lengthened use simply put a glaze upon them. As bearing upon the life of the wire mantel itself, he might say that with a full fire the mantel was so cool that it could be held in the hand.

Fuel Gas from Anthracite Coal.

In a paper on this subject read by Mr. J. Gardner, before the Scranton (Pa.) Board of Trade, the author said:

The late Denny Lane, who was a gas engineer of prominence, stated before the Institute of Civil Engineers that, "with ordinary town gas,

16-candle power, 3,000 horse power could be sent a distance of one mile for an expenditure of one horse power, and economy of distribution far exceeding that possessed by any other system, either hydraulic, pneumatic or electric, being only 1.30 per cent. of the power conveyed." I found at the Otto Gas Engine Works, West Philadelphia, where they employ gas engine power, the gas being produced with buckwheat coal, costing $2.65 per ton in their bins, that their weekly cost per horse power for fuel was 6 cents and under, and that one pound of coal furnishes one horse power per hour. The Otto Company guarantees one horse power per hour for 1¼ pounds anthracite pea coal, with producers and engines of their own construction. They assert practice has demonstrated that 18 cubic feet of gas per hour are required for each 1,200 candle power arc light per hour on a circuit of several miles, embracing 130 lamps. This would be at the following cost for gas in holder, an expense to each lamp per hour as follows:

At 10 cents for gas, equals 1.8 cents per lamp.

At 5 cents for gas, equals .9 cent per lamp.

At Danbury, Conn., gas and electricity are furnished by the same company. They have three 100-horse power gas engines, run with producer gas made with anthracite egg coal, costing, at the time of my visit, $5 per ton. They are satisfied that they have a very economical plant, and say they get one horse power per hour with one pound of coal.

Now, as to what we are able to do with the millions of tons of waste coal scattered through the coal regions. After working over the piles and extracting all the marketable sizes, the earth will still be encumbered with millions of tons of unmarketable stuff. With this I am prepared to make a gas as valuable for fuel as the best prepared coal, and far more efficient in power-using gas engines than the best of coal with steam engines. Special devices were necessary in the use of culm. It could not be used in any of the producers before made. To force the necessary amount of air for combustion, and steam for decomposition, uniformly, through a mass of fine culm from 3 to 4 feet deep, requires not only considerable pressure, but an equal distribution of the air and steam through the mass, with no vertical openings for the dust or culm to fall in or through, or to blow openings—called volcanoes—up through the fuel, also means for maintaining a uniform depth of fuel.

These provisions being worked out, we are able to produce gas with this material without more trouble or cost than with prepared coal, and this we have been doing for several months. By actual measurement, we produce and store from 120,000 to 188,000 cubic feet of gas with one ton of fine waste from the washing. With culm from the pile, after taking out all sizes above buckwheat, we get about 140,000 cubic feet per ton. Fifty cubic feet of gas in a gas engine is a large allowance for one horse power per hour; hence one ton of culm will furnish 2,800 horse power per hour, or 230-horse power for 10 hours, and there is no waste of fuel when the power is not in use. No boilers to care for, insure or explode, and but little expensive water required.

Aside from cheap power, we have a cheap and convenient fuel. As an instance, at Oxford, N. J., gaseous fuel from anthracite buckwheat was used in all the furnaces at the nail works, and Mr. Lukins informed me that about 600 pounds of buckwheat coal, converted into gas, did the work of 1,000 pounds of egg coal used direct. Besides the convenience of handling and certainty of the heat, was freedom from dust and sulphur.

For domestic purposes, gaseous fuel is in every way most desirable, and is being extensively used even where more expensive than coal.

The gas made with anthracite coal is not of itself illuminating, but with a Welsbach burner it gives a bright, white incandescent light. I have carbureted the gas, making it luminous and increasing its efficiency. This would add but little to its cost, and might be desirable for domestic purposes.

I know of no device enabling us to use the waste from the washery under the boilers, and it is well known there is great waste of fuel in burning the average culm. The efficiency of boilers is greatly increased by use of gas, and their life extended; and where culm is used it would be economy to generate gas and use it under the boilers instead of using the culm direct.

Commercial Testing of Gas Coal.

[A paper read by Mr. THOMAS GLOVER, of West Bromwich, England, before the Midland Association of Gas Managers.]

If there is one thing more than another upon which the successful working of a gas works depends surely that one thing is the choice of coal. Coal is the base upon which we build; if we choose well and wisely, the first step has been taken towards a good balance sheet. It may be said that good coal must be followed up by good management in other directions if success is to be looked for; and that is no doubt true. What I desire to emphasize is the fact that the choice of coal is the starting point, which, if overlooked, no amount of attention in other branches of manufacture or distribution will make up for.

There are gas coals which have earned a good name, and may be looked upon as standards whereby to gauge other coals not so well known. The reputation of some well known coals is well deserved, seeing that year after year their merits have been tested in the most practical way; and so long as the price is kept at the normal market value the gas manager may be excused if he gives a seemingly cold shoulder to the claims of new rivals. This confidence, however, may sometimes be carried too far; and if tests were made the results obtained from some of the coals upon which we have placed so much reliance would sometimes cause no little surprise.

When we consider the wide area over which our coals are mined, and the possible difference in locality from which the coal is obtained at the same pit, we can understand that the nature of a seam may be different when examined, say, at intervals of five years' time, due to the altered position in the coal basin from which the coal is being mined. This is a good reason why periodical testings of all coals which are in use should be made.

With the manager who is wide awake, and who wishes to keep himself up to date, coal testing will not be confined to one or two favorite "brands" of coal. If he is the happy possessor of a convenient testing plant, he will launch out into new fields, and it may be that his findings will be of considerable value to his undertaking.

To illustrate this point the author will venture to refer to an instance in his own experience. As is pretty generally known, most of the Durham coals are particularly free from sulphur, while the West Cumberland gas coals have not such a good character in that respect. At a gas works situated at almost equal distances from the two coal fields, it will be easily understood that the coal which was relatively free from sulphur was almost invariably chosen, to the exclusion of the one which contained rather more than a fair share of that impurity. On the occasion of the opening of a new pit in West Cumberland, to work a well known seam, the gas manager was prevailed upon to make a series of tests; and it was a pleasant surprise to find that the gas and the residual coke contained only a low percentage of sulphur, whilst the yield of gas and the illuminating power were such as to place it amongst first class gas coals. The purity of the gas and coke in regard to sulphur was found to have been considerably improved by new methods of cleansing the coal from impurities at the colliery, with the result that a considerable percentage of sulphur, etc., was removed; hence the improvement which was found in the quality of the gas and residuals.

Other instances of the same kind might be quoted nearer home, but sufficient has been said to show the importance of looking at the subject with unprejudiced minds, and, whenever possible, of verifying the information already possessed, as well as of seeking to know the character of all likely coals which are offered.

In gas works where the output of gas is from 10 to 50 million cubic feet per year, and where there are no stringent conditions as to illuminating power, there is no difficulty in making a 12 or 24 hours' working test at any time of the year. In works of greater output there may be considerable difficulty in making such a test; hence the necessity for having a separate plant where comparatively small quantities of coal may be dealt with; and no moderate or large-sized works can be regarded as being complete unless it has an experimental test plant.

The coal testing plant should, as far as possible, be a gas works in miniature; with every facility for measuring accurately the products from the coal under test. The conditions and methods of working should be similar to those practised on a large scale. There should be always more than one retort in the bench, so as to allow the retorts to be charged alternately. In this way the light gases from one charge are mixed in the hydraulic with the heavy gases from a new charge, and the process becomes similar to that which experience has shown to be the best for ordinary working.

With a test plant similar to the one about to be described it is possible to make two, or, at a push, three tests in one day. The weight of coal used per test would be from 2 to 3 cwt. The results, therefore, would be of much more practical value than those obtained by the distillation of a few pounds. If circumstances will allow, it is an advantage to have such a test works in close proximity to the manager's laboratory, so that the assistant who is engaged on the chemical analysis of the coal, coke, gas, etc., may supervise the work of drawing and charging and be ready to take the photometrical tests at the right time.

The three great factors, exclusive of price, which control the choice of coals, may be said to be yield of gas by volume, illuminating power, and weight and quality of coke. To facilitate comparison previous to buying, when a large number of tests are made, it is advisable to reduce these three items to one figure, viz., cost per candle-thousand. This is arrived at by dividing the cost of the coal in pence, less the value of coke, by the candle-thousands. The value of the tar and liquor is purposely avoided in this calculation because of the difficulties of estimating their true volume.

With two retorts the work of testing would be commenced by putting in a light priming charge, for the purpose of clearing the pipes and apparatus of air or stale gas. A carefully weighed charge of ½ cwt. would then be put in, and the time noted. In an hour afterwards the second retort would be similarly charged. At the third hour the first would be drawn and charged again ; and so on until, with steady production each hour, the yield has been accurately decided.

Each charge of coke is weighed hot, so that no inaccuracies occur through water being absorbed in quenching.

The state of the meter, taken every hour, gives the production from ½ cwt. of coal ; from which the production per ton is readily calculated. The temperature at which the gas is registered should, of course, be carefully noted, and corrections made.

The illuminating power may be taken every two hours, and the average of these tests may be regarded as reliable. The gas for testing purposes may be collected in a 10 cu. ft. capacity gasholder within the laboratory, the bulk of the gas being passed on to the town mains, or, preferably, to the inlet of the works' exhauster. A holder of sufficient capacity to store the whole of the test gas is thus dispensed with, a sample stream being constantly taken off into the laboratory holder. This method of collecting samples of gas is not only useful with a test plant, but will be found equally valuable when it is desired to find the illuminating power of the gas from the works over any period. A carefully regulated stream, say 2 cubic feet per hour, being supplied to the test holder, care should be taken, in any case, not to have a long length of supply pipe unless means are provided to get a good stream to flow through it.

When a works' test of a sample of coal is being made the small holder has many advantages over the old system of using a large holder ; and the tests can be made more frequently and will therefore be more reliable.

The three chief items which control the value having been decided, other important items of information will be obtained in the laboratory. These are — specific gravity, sulphur in volatile products, sulphur and ash in coke, and the calculations in regard to sperm value. These facts properly tabulated, along with the price and the cost per candle thousand, will enable the gas manager to decide at once upon the coal having the most advantages for his purpose ; and with a plant such as the one I have described the manager of any moderate sized works may have information which will be of far greater value than that which is sometimes submitted on elaborate sheets of analysis.

It will probably be found advisable to make a comparison of the results which can be obtained on a working scale, when the plant is in an average condition, with those produced in the test works, and, if necessary, an allowance can be made for the difference.

This somewhat discursive paper may be summarized as follows :

(1) It is advisable to test well known coals periodically, and an advantage to have facilities for making rapid but accurate tests of all suitable coals which are offered.

(2) For this purpose, in moderate and large sized works, a test plant should be provided.

(3) It is not necessary, in such a plant, to collect in a large holder the whole of the gas from the coal under test, a sample of, say, 10 cubic feet being easier to manipulate for accurate testing.

(4) The results from such a test plant should be compared with those made on a working scale, so as to arrive at the results which may be expected when the coal is used under ordinary conditions.

Appendix to Mr. Glover's Paper.—Suggested Design for a Book to Keep a Record of Coal Tests.

RECORD OF COAL TESTS.

Date.	Name of Firm.	Description of Coal.	Price per Ton of 2,240 Pounds.	Weight of Coal Used.	Gas Made in Cubic Feet, at 60° F.	Gas Made per Ton at 60° F.	Weight of Coke per Ton of Coal, in Lbs.	Value of Coke per Ton of Coal at Market Price.	Cost of Coal, Less Value of Coke.	Illuminating Power in Standard Candles.	Cost per Candle-Thousand.	Sperm Value per Ton of Coal.	Sulphur Eliminated with Volatile Products.	Sulphur in Coke, per Cent.	Ash in Coke, per Cent.	Specific Gravity of Coal.

Underloaded Engines.

A writer in the *Scientific Machinist* says that when we speak of the evils of trying to run an overloaded engine we are readily understood by even a tyro, but when we commence to tell of the evils of an underloaded engine, our meaning is not so apparent. The engineer who is running a Corliss engine with a light load, so that he must either listen to an exasperating rattle of his exhaust valves or else throttle the pressure until the point of cut off is lengthened sufficiently to give a much higher terminal pressure than would otherwise be necessary, knows of one evil due to the light load; but it is not of this that we wish to speak particularly at this time.

Suppose that we have an automatic engine running with a high boiler pressure, and cutting off at a point that gives, say, 20 pounds terminal pressure absolute. We calculate the water consumed per hour, as shown by the diagram, and dividing the amount by the horse power developed, find that our rate of water consumption is low. After a time some of the machinery is stopped and we find that the terminal pressure is now but 10 pounds absolute. The weight of steam used per hour at this high pressure is now a great deal less than before ; consequently, when we divide one by the other we find that the rate is much greater than when more power was used. In other words, it costs more to develop a horse power than before the change was made.

One reason why it may seem to be to the contrary is that when our terminal pressure is high we exhaust the steam when it seems as if there was much useful energy in it, which is thrown away. If we use it until more of this energy is used, or in other words, until the terminal pressure is lower, is it not reasonable to expect that the efficiency will be greater ? When the terminal pressure is high the cylinder is kept warm, but when it is low then the temperature of the cylinder is lowered accordingly, so that when another charge of steam is admitted much of it will be condensed in warming it up again. This is a loss which the diagram does not fully show, but it affects the results greatly. This condensation leaves some water in the cylinder, as a matter of course, and after the cut off has taken place, and the pressure falls, the heat present may evaporate this water.

At first thought it may not be plain why this does cause a loss, but it should be remembered that the heat taken to evaporate this water comes from the cylinder, and as a natural consequence, must reduce its temperature, hence the loss when another charge of temperature is admitted. As a rule unloaded engines give steadier speed in the mill or factory than overloaded ones do, for the simple reason that if an engine is loaded beyond its capacity it cannot maintain its speed. This is a consideration that may far outweigh the slight difference in the cost of producing steam to develop a horse-power with a light load. Every engine should be so made, however, that it will not race when the load is thrown off, for the governor should be so adjusted that at its highest point it will not allow the valves to admit any steam to the cylinder, hence excessive speed will be impossible. Cross compound and tandem compound engines, of medium and large sizes, are coming into very general use, and the competition among engine builders is so sharp that some of them may be found that are running at speeds which bring the rim of the flywheel very nearly, if not quite up to the danger line when at regular speed. If the load is thrown off suddenly, or an attempt is made to run with a very light load, the speed will vary greatly. It is more difficult to avoid this, with such an engine, than where a non-condensing engine is in use, for just before the load is thrown off, a heavy charge of steam may be admitted to the high pressure cylinder, and this

passing to the receiver and to the low pressure cylinder, gives the parts a momentum which is felt during the next stroke, especially as the effects of the vacuum operate to assist this undesirable state of affairs. The consequence is that before the engineer can get to the throttle valve and shut off the steam, the flywheel is running at a dangerous speed, and there is little doubt that some of the flywheel accidents that have proved so disastrous, were caused in this way. Such engines should be fitted with the most sensitive governors made, and the valve gear should not only be adjusted correctly when first set up, but it should be inspected and tried at short intervals, that it may be kept ready for an emergency.

The Explosive Properties of Acetylene.

Some experiments recently completed by Messrs. Berthelot and Vieille show that considerable precautions are necessary in dealing with acetylene, particularly in the compressed state. The gas in question is an endothermic body—that is to say, a quantity of heat is liberated on decomposing it into its constituents, hydrogen and carbon. Reasoning on this basis, the experimenters determined to try whether the gas could not be detonated by means of a cap of fulminate of mercury. This proved possible, though at atmospheric pressures the explosive wave did not proceed throughout the body of the gas, the decomposition being limited to the immediate neighborhood of the detonation. When, however, the gas was compressed, the experiments showed that it might prove a dangerous explosive. In fact, it was not then necessary to use a detonater, as it was found that the mere heating of the gas by an incandescent platinum wire was sufficient to cause an explosive decomposition of the acetylene. Average figures from a number of experiments made with different degrees of initial compression showed the following rises of pressure :

Initial Pressure. Lb. per Sq. In.	Maximum Pressure Observed on Explosion. Lb. per Sq. In.	Ratio.
31.7	138.7	4.4
49.4	271.0	5.5
85.1	600.0	7.0
160.0	1,312.0	8.2
301.0	3,028.0	10.1

On opening the steel test tube after an experiment, it was found to be filled with a mass of finely divided carbon agglomerated together by the increase of pressure. The rise of temperature at the moment of explosion was considerable, and in the case of the last of the experiments, referred to above, amounted to as much as 2,750° C. It was, morover, found possible to detonate liquefied acetylene in the same way, a pressure of over 35 tons per square inch being then attained. The explosion was started, as in the previous cases, by means of a white-hot platinum wire. Dropping a bottle of the liquefied gas, or allowing a heavy tup to fall on it, proved insufficient to detonate the mixture, although when the bottle was broken by the tup a violent explosion occurred. This, however, arose from the combustion of the gas, and thus differed materially in nature from the experiments previously made, in which the acetylene was merely resolved into its elements.

The Fire Risk in Belt Transmission of Power.

By Mr. Wm. Elmer, Jr., in *Electrical World.*

In conversation with a well-known mechanical engineer recently, the topic finally reached was the problem of the modern systems of transmission of power. Various phases of the matter were discussed, and at last the question of fire risks was brought up. The relative safeties and dangers of the belt and line shaft methods were contrasted with the systems using electric motors, and the writer, who is an advocate of electric power in small units, undertook to hold up that end of the debate. The well known dangers of hot journals were pointed out and the opposing side adduced the heating of wires from overloads on the failure of fuses to blow. This overheating of wires is a matter of which we have heard a great deal in times past, and of which we hear considerable at the present time, but it seems that the condition of affairs must have been exaggerated. Every fire in a manufacturing establishment which is not proven to be due to some definite cause is, for want of a better scapegoat, assigned to a defect in the electric wires. Truth compels the statement that in a great many electrical installations, particularly those made some time ago, the wiring is in very bad shape. Wooden cleats can be found in abundance, wires run under and in contact with pipes, lamp cord hooked up on nails and circuits overloaded by the continual addition of lamps. These things are bad enough, and should be remedied at once, for no one can tell when the time may come for the catastrophe to occur. It has often occurred to me that the underwriters would have their hands full for about a year if they did nothing else but go around the country condemning the old wiring which is such a menace to the owners of the various establishments where it is to be found.

But granted that all these things are so, the question is, do the fires started by electrical troubles cause more damage than those started by hot boxes? Statistics will prove that they do not. A single instance of a fire in a belt system of transmission of power will serve to illustrate the point. In a certain mill, which shall be nameless here, one room was cut off entirely from the main floor by a solid brick wall. This wall was pierced by but two openings, these being merely horizontal slots wide enough to allow a belt to pass through. The main line of shafting drove the isolated machines in this small room by means of a belt which came through these slots in the wall. A short countershaft received the power and distributed it as needed. The mill happened one week to be working overtime in certain departments, so that this left the main floor unoccupied. The engine which supplied the whole establishment with power had to be run and drive all the line shafts in the building. This gave the few attendants an unusual amount of work, and for some reason the countershaft in that certain little detached room was neglected. It does not appear that the thought ever occurred to the oilers that the isolated situation of the room immunized the mill from the risk of a fire starting there, but it would certainly seem that if a fire had to start that was a pretty safe place to have it begin. A solid brick wall is considered a very good fire insulator, and the presence of those two small slots would hardly be taken into consideration.

But let us see what really did happen. After an indefinite number of thousand revolutions, a box on that countershaft became dry. After some more revolutions it ran hot and finally blazed up. The shafting and hangers in the mill were caked with dirt and oil, and the next thing that happened was that the lint and dust on the belt caught fire. The fire traveled with the revolving belt through the openings in the wall and ignited the grease on the hanger nearest the driving pulley on the main line shaft. Then the oil and dirt on the shaft carried the flame along from one hanger to the next until, in less time than it takes to tell it, the whole floor was ablaze from end to end. The mill was doomed and burned to the ground. "For the want of a nail, etc."

This is but a single instance, but it might be multiplied indefinitely. There are plenty of cases of blazing boxes and journals every day. Who has not seen half a dozen a year on the various railway trips he has taken? And if a car journal can run hot, why not a line shaft box? The truth is, it is only by the most constant vigilance that this danger is averted, and any neglect on the part of the man with the oil can is liable to be paid for dearly.

Vertical belts are also a source of great danger, as the openings they necessitate from floor to floor form great chutes for the transmission of fire from cellar to roof. A fire once started in the basement roars up one of these sets of openings as up a chimney, and nothing can stop it. The evident remedy is to have no vertical belts. Drive each section of shaft by its own motor. Better still, drive each machine by its own motor. Then, if any one floor, or part of a floor is wanted, everything else can stand perfectly still. In working overtime any part of the shops can run in entire independence of any other part, and there would be no necessity for constant attention to the boxes of revolving shafts all over a big building. Properly wire a structure in the first place, and provide each motor circuit with an efficient circuit breaker, and there will be no more danger from the electric wires than from the girders themselves.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Riverside (Cal.) Gas and Electric Light Company, the officers chosen were: Directors, B. F. Burt, J. H. D. Cox, W. A. Hoyt, J. S. Castleman and C. P. Hoyt; President, W. A. Hoyt; Vice-President, C. P. Hoyt; Secretary and Treasurer, B. F. Burt.

The Supreme Court of New Jersey has handed down a decision, affirming a judgment made some time ago by the Camden County Circuit, in the case of Mrs. Lydia Robinson against the Camden Gas Light Company. Complainant sued for damages to person, sustained through slipping on a sidewalk in front of the Company's works, from which sidewalk an accumulation of ice and snow had not been removed. The award amounted to $2,375.

It is reported that the gas interests of Kenosha, Wis., are to be reorganized, and that Milwaukee capitalists will perfect the changes.

Mr. Meeds, Gas Inspector for Minneapolis, Minn., in his report on the illuminating value and purity of the gas supplied in that city for October, says that it was well above all the statutory requirements. The candle power averaged 24.40, and the sulphur content was 19.71 grains. The average consumption in the street gas lamps was 6.32 cubic feet per hour. The ammonia content was 1.34 grains.

The damage done to the generating plant of the Ashland (Pa.) Gas Light Company, because of the recent explosion therein, has been very much overstated. Instead of the loss amounting to $5,000, as at first stated, it will not exceed $600.

Superintendent Dunbar, of the Pittsfield (Mass.) Coal Gas Company, has completed an important addition to the Company's main system.

In response to the invitation of the authorities of Jersey City, N. J., for proposals for the public lighting of that place, the following bids were submitted by the gas interests: Welsbach lights, United Gas Improvement Company, one year contract: If the city is to pay for reglazing broken lamps, graduated monthly rate, varying from $1.96 in June to $3.48 in December, or $32 per lamp per year; if the contractor is to do the reglazing, $2.26 in June to $4.03 in December, per lamp, or $37 per lamp per year. On a 3-year basis, city to reglaze, $31 per lamp per year; if the contractor is to reglaze, $36 per lamp per year. On a 5-year basis: If the city is to reglaze, $31 per lamp per year; if the contractor is to reglaze, $36 per lamp per year. Every Welsbach burner is to yield a light equal to 60 candles. For ordinary street gas lamps, the only bidder was the United Gas Improvement Company, the proposal from which was: One year contract, if the city is to reglaze, $1.49 per lamp in June to $2.67 per lamp in December, or $24 per lamp per year; if the contractor is to reglaze, $1.80 per lamp in June to $3.21 in December, or $29.50 per lamp per year. On a 3-year contract, if the city is to reglaze, $23.50 per lamp per year; if the contractor is to reglaze, $28.50 per lamp per year. On a 5-year contract, if the city is to reglaze, $22.50 per lamp year; if the contractor is to reglaze, $27.50 per lamp per year. Under the present arrangement the city maintains 782 arc electric lamps, 550 gas lamps and 1,000 oil lamps.

The Boston *Globe* says: The Brookline Gas Light Company has filed with the Massachusetts Board of Gas and Electric Light Commissioners a report covering its operations for the year ended June 30th, 1896. Comparison with previous year follows:

	1896.	1895.
Income from sale of gas	$678,931	$467,467
Income from sale of electric light	92,403	85,138
Operating expenses, gas	485,874	437,244
" " electric light	72,728	70,626
Net—gas	193,057	30,222
" electric light	19,675	14,512
Other income	68,817	408
Total net income	281,549	45,143
Interest payments	155,216	156,325
Depreciation	12,689	129,854
Mitcellaneous charges to profit and loss	174,759	....
Deficit	61,115	241,036

The total deficit on June 30, 1895, was $242,475, $1,439 having been brought forward from previous year; deficit June 30, 1896, $303,595. In the item "miscellaneous charges to profit and loss," there are included items appearing in the account as "repairing and setting stoves, $40,968," and "setting burners and fixtures, $28,064." Whether these items are properly chargeable to this account, is questioned by the Commissioners, and they will investigate the matter. The Company sold during the year 690,110,000 cubic feet of gas, as compared with 469,914,633 cubic feet the previous year. The Company has in use 22,891 meters, as against 18,026 on June 30, 1895. The balance sheet shows total assets of $4,417,982, of which $125,895 is due for gas, $166,973 for stoves, etc., on hand, and cash on hand, $49,015. A year ago, total assets were placed at $4,019,397; liabilities are $4,721,578, including notes payable, $1,611,500; unpaid bills, $26,116; unpaid interest, $55,641; reserve fund, $25,000. A year ago total liabilities were $4,261,873.

A correspondent writes that a change in the management of the Alameda office of the Oakland (Cal.) Gas Light and Heat Company, is not at all unlikely, although the substitution may not occur before January 1st. Rumor has it that a Mr. Mitchell, of Oakland, is to be the new appointee, and further gossip respecting the situation is that the local offices will be removed to a location better adapted to the convenience of the gas users of Alameda.

Early this month the case of Geo. P. Cody, of East Dedham, Mass., against the Dedham and Hyde Park Gas and Electric Light Company, was tried in the Superior Court, before Judge Dunbar and a jury. The case was an action of tort brought to recover damages for personal injuries which the plaintiff received December 6, 1895, while in the employ of defendant, through the caving in of a trench, on Milton street, East Dedham, in which he was working. The jury found for plaintiff, assessing the damages at $2,500.

It is thought that the new generating plant for the Fairbault (Minn.) Consolidated Gas and Electric Light Company, will be completed by January 10th.

The new Board of Directors in charge of the properties of the Bay State gas group are: Messrs. H. H. Rogers, William Rockefeller, Albert C. Burrage, John G. Moore, Sidney Chase, Robert Amory and Henry M. Whitney. The Directors elected Mr. A. C. Burrrage to the Presidency.

The Richmond Hill and Queen's County Gas Company, of Richmond Hill, L.I., which proposed to supply gas in certain territory between Jamaica and the district formerly known as East New York (which latter is now a part of Brooklyn), is in financial difficulties. It is to be hoped, however, that either the Company named, or another, will speedily occupy the field, which promises to be a fairly remunerative one for gas suppliers.

It is again reported that all differences between the authorities of Buffalo and the backers of the Queen City Gas Company, of Buffalo, N.Y., which differences largely hinged on the adequacy of the bond submitted by the Company, guaranteeing that it would abide by all the restrictions adopted and enacted by the Board in connection with the operations by the Company within the city, have been satisfactorily adjusted.

An attempt is to be made to better the condition of the gas supply of Brownsville, Tenn., which should not be very difficult to accomplish.

An ordinance granting an extension of time, from December 6th, 1896, to September 6th, 1897, to the E. J. Acker Construction Company, to construct an electric light plant and gas works in Norfolk, Va., and to conduct all work necessary for this purpose, was recently considered by the Common Council of Norfolk. The ordinance was referred to the Ordinance Committee.

Amongst the many improvements made on the plant of the New Haven (Conn.) Gas Light Company this season, was the construction of a new meter house, in which was installed a meter rated to pass 2,000,000 cubic feet in 24 hours. The constructor was the American Meter Company.

The Glens Falls (N.Y.) Paper Mill Company, is making extensions in its various plants, and has placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for a new pulp mill, at Cadyville, N.Y. The contract also includes a water tower and boiler house. It has also placed an order with the Berlin Iron Bridge Company, for additional buildings at the Kent's Falls plant, the structures to comprise a pulp mill, boiler house, "barker" room and wood room. This contract is quite a large one. Orders for machinery for equipping the various buildings will be placed at once.

A serious accident occurred recently in the power room of the Rochester (N. Y.) Gas and Electric Company. A large flywheel, 18 feet in diameter, with a 42-inch face, and weighing 20 tons, burst, the fragments making their mark in every direction. Two steam lines were severed, and an arc lighting circuit on street lamp service was cut out for about an hour. The damage done was considerable, but Supt. Redman speedily succeeded in putting the plant in going order.

The Boston *Transcript*, in reporting the business transacted at the postponed annual meeting of the Brookline (Mass.) Gas Light Company, says: "All but 35 shares of the capital stock of the Brookline Gas Light Company were represented at the adjourned annual meeting. The old

Board of Directors was re-elected as follows: Robert Amory, S. W. Lawrence, H. H. Rogers, Sydney Chase and H. M. Whitney. Dr. Amory was re-elected President and General Manager, Mr. C. L. Crehore was chosen Clerk, and Mr. Harcourt Amory was appointed Treasurer. The Company will not accept the award of the Board of Gas and Electric Light Commissioners approving an issue of $435,000 bonds, instead of $1,000,000, as asked. The valuation of the Brookline Company's property, as shown by the appraiser appointed by the Commissioners, it is reported, showed assets of more than $4,125,000, not including the furnishing of the main office in Boston. President Amory says there will be no immediate change in the management of the Gas Company, other than that expenses will be reduced to a minimum."

HANS LUND, City Comptroller of Kansas City, Mo., has directed the Missouri Gas Company to pay into the City Treasury 2 per cent. of its gross receipts, for the six months ended September 30th. The first payment was due Oct. 31st, but the Company asserts that its receipts during the first month of its existence were so small that the 2 per cent. thereon was not worth considering. Mr. Snyder, the President of the Company, was not in the city when the demand was made, but the latter will be satisfied immediately on his return.

MR. CHARLES R. FABEN, JR., the wide-awake engineering genius of the Toledo (O.) Gas Light and Coke Company, recently accompanied a reporter of the Toledo *Commercial* through the Company's new plant, some details of which were published last month in the JOURNAL. On taking his leave the reporter asked: "Is not the electric light incroaching upon you?" To which query Mr. Faben replied: "Not at all; we hardly know there is such a thing."

THE Flatbush (N. Y.) Gas Company has filed a certificate with the Secretary of State by virtue of which it declares its intention to extend its business to the city of Brooklyn and throughout Queens county.

ON the 9th inst. the Trustees of College Point, L. I., decided to substitute Welsbach burners in the street lamp lanterns for the burners of the ordinary type hitherto used. The contract calls for the maintenance of 63 lamps, to be kept alight every night and all night, at the rate of $35 per lamp per annum. This price includes repairs, etc.

ELSEWHERE we note the fact that the franchise granted to the proprietors of the Richmond Hill and Queens County Gas Light Company, which proposed to do business in a certain district of Long Island, N. Y., was likely to be revoked. It seems that surmise was pretty well founded, for on the night of the 9th inst. the Boeklen Gas and Construction Company applied to the Trustees of Richmond Hill for the right to supply gas in the territory covered by the grant which it is thought is about to lapse. The projectors of the new concern propose to begin construction work within one week after the franchise is signed, and promise to have the plant in working order, to the point of being ready to supply gas to consumers, within 90 working days from the signing of the grant. The rates proposed are: $1.25 per 1,000 cubic feet for ordinary use and $1 per 1,000 cubic feet for consumption on public account. Street lamps (ordinary type of burners) are to be maintained at the rate of $18.50 each per annum; if Welsbach burners are used, the rate per lamp per annum is not to exceed $21. The franchise is to run for 50 years, and contracts for street lighting are to be made for periods of 5 years. The village treasury is to receive 1½ per cent. of the gross receipts of the Company, and a sliding scale of prices is provided for, under which the selling rates are to be lowered as the consumption increases.

THE Pawtucket (R. I.) Company is completing the piping of the outlying district known as Fairlawn, in which territory it has already secured many customers.

ACCORDING to the New York *Sun*, of the 11th inst., the annual meeting of the Brooklyn Union Gas Company was held, on November 10th, at the Company's main office, 180 Remsen street. It is just a little over a year since the various Brooklyn Gas Companies were consolidated, and a large number of interested stockholders were on hand to hear how the Company had progressed. Felix Campbell, President of the People's Trust Company, presided, and C. H. Stoddard acted as Secretary. The following Board of Directors was elected: Wm. Rockefeller, Henry H. Rogers, John G. Moore, James Jourdan, David G. Leggett, Henry W. Cannon and Elverton R. Chapman. The stockholders were invited to ask any questions which might suggest themselves about the affairs and management of the Company, and this invitation resulted in quite a general discussion. Treasurer Chapman announced that the recent decision of the Attorney General, that all the other Companies which had joined in the consolidation had forfeited their charters, virtually ended their existence, and placed the Union Company on solid ground. Mr. Chapman also made the announcement that the Company had earned enough to pay a 6 per cent. dividend on the stock, and to place a substantial amount to the credit of the surplus account. He congratulated the shareholders on the result of the first year's operations of the Company and predicted increasing prosperity for it. The contract of the Company with the city has expired, and the gas is being supplied at the old rates. It is thought that either a 5 or 10-year contract will shortly be entered into between the city and the Company, the arrangement for which is still under consideration by the Board of Aldermen.

THE proprietors of the Ogden Gas Company, of Chicago, assert that they will be ready to supply gas in the north side of the city on or before February 1st.

THE new holder constructed by the Stacey Manufacturing Company for the American Gas Company's plant at Elgin, Ills., is in all respects satisfactory. Its capacity is 250,000 cubic feet; it rests in a steel tank, and it is one of the "objects of interest" in Elgin.

A CONTRACT for 25 air compressors and 25 air receivers, of medium and small sizes, has been closed by the Clayton Air Compressor Works, Havemeyer Building, New York, with one company, delivery of the entire order to be made within six months from date. They also report sales of five air compressors of standard pattern during the first week in November, and indications point to a decided revival of trade in air compressors, many orders having been held in abeyance, pending the result of the election.

Artificial and Natural Petroleum.

M. Francis Laur, in a communication to the *Echo des Mines*, calls attention to the unexpected discovery of the artificial production of petroleum, which, he says, starts a new question of great interest to scientists, as to whether petroleum is an ancient deposit in the earth's surface or is being reproduced to-day in the lower series of measures. Those who consider that the production of petroleum is contemporaneous are, says M. Laur, unable to account for the method of its formation, and have to be content with the mere hypothesis of certain obscure reactions which took place in the bowels of the earth. Now, however, it is only needful to invoke the presence of the metallic carbides which exist in the central nucleus, and which can be reached by the water which is sucked in through the earth's crust, so that it is rational to suppose that firedamp, acetylene, petroleum, tar and inflammable gases of all kinds may be produced and infinitely modified by the difference of pressure and temperature. Arguing from this point, M. Laur suggests that Lake Baku must, if this is the case, be the outward and visible sign of a natural production of hydrocarbides, while the Caspian Sea, whose issue has not so far been determined, but whose boundary does not grow less, may be regarded as a natural means of feeding the important internal laboratory where the petroleum is produced.

The Chevalet Treatment of Feed Water.

The London *Journal* "notes" that yet another feed water heater, this time combined with what is called a "detartarizer," is being brought under the notice of British steam users. A specimen plant of the kind is in operation at the West Brompton central electric lighting station, where it is treating and supplying nearly 3,000 gallons of water per hour to the battery of Babcock & Wilcox boilers, using only the exhaust steam. The purification of the water for raising steam is brought about by boiling it with the heat of the exhaust, thereby causing the lime to be deposited as a compact sediment in the receiving chamber of the machine itself. The action of the apparatus appears to be very similar to that of a Livesey gas washer. For dealing with the sulphate of lime, or permanent hardness of the water, a small addition of carbonate of soda is made to the water as it enters the apparatus. A very small pump is employed for this purpose, worked in connection with the boiler feed pump; so that a predetermined amount of soda solution is taken in with the feed. The soda (by double decomposition) changes the sulphate of lime into carbonate, which is then precipitated by the boiling action, while the sulphate of soda remains in the water as a soluble salt. The result of the working of the combined apparatus is stated to be that the water retains not more than 3° of hardness.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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MONDAY, NOV. 16, 1896.

The Market for Gas Securities.

The attention of investors was very marked in respect of Consolidated shares during the week, and persistent inquiry resulted in sending the stock up 10 points over the quotation of a week ago. The high-water mark was 164½, and the opening to-day (Friday) was made at 164 to 164½. Several causes have been assigned by speculators in accounting for this sharp upward movement, but we imagine that the actual reason is the intrinsic value of the business and property underlying the securities. It is, though, not at all improbable that the scheme for merging certain of the New York Companies is rather more than in the embryonic stage, from which point of view Consolidated would look very cheap at current prices. The pronounced rise in New York and East River common is said to be traceable to the fact that good, round lots of the shares have found their way into the hands of parties who are not at all inimical to the interests of the Consolidated Company. The common is bid for at 41, while the preferred is rated at 70 bid. Mutual also shared in the advance, and it has been inquired for at a minimum of 238 bid. Standard issues are nominally unchanged, while Equitable is again well above the 200 mark.

Brooklyn Union is much firmer, at 95 to 96. The first annual meeting of the Company was held on the 10th inst., and some account of the same will be found in our current item columns. The Board of Directors was reorganized, the people really in interest taking up unconcealed control. The election of officers takes place to-day, and we imagine one would not be far out of the way in predicting that Gen. Jourdan will be elected President. The showing made by the Company for the year was an excellent one. The fixed charges and over 6 per cent. on the stock have been earned, and certain projected economies, that are shortly to be carried into effect, will greatly add to the Company's earning powers. The stock of the Company is very cheap at anything under par. Its bonds are 106 bid. The action of the managers of the Chicago Company in putting that property on a 6 per cent. basis (a dividend of 1½ per cent. was declared last Friday) has kept the stock firm. It opened to-day at 78⅜ to 78½. Bay State gas, on an application by counsel for Messrs. Godfrey Morse, the executors of Leopold Morse, L. J. Logan and P. K. Lincoln, of Boston, for receivers for the Bay State Gas Company, of Delaware (which application was made before the United States Circuit Circuit, Delaware district, on the 11th inst.) is very much weaker. The slump in it was further assisted by a rumor that the stock would be subjected to an assessment. Consolidated, of Baltimore, is in demand, at 66¼ to 67, and Lacledes are steady at last week's quotations.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

Nov. 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	164	164¼
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	205	215
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	238	250
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	41	43
Preferred	2,000,000	100	70	73
Bonds 1st 5's	3,500,000	1,000	95	98
" 1st Con. 5's	1,500,000	..	104	107
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	83	..
Preferred	5,000,000	100	106	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	108	..
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	95	96
" " Bonds (5's)	15 000,000	1,000	106	107
Bay State	5,000,000	50	14¾	15
" Income Bonds	2,000,000	1,000	27	30
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	88	..
2d " " "	3,000,000	1,000		76
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	78⅜	78½
Chicago Gas Lt. & Coke Co.				
Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	75	85
" Bonds	600,000	1,000	99	101
Cincinnati G. & C. Co.	7,000,000	100	201	202
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	30
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	66¼	67
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	83
" Bonds	2,000,000	..	82	86
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	125	132
" Bonds, 6's	2,650,000	..	103	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	82	87
Bonds	1,000,000	1,000	85	90
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	28	28½
Preferred	2,500,000	100	70	80
Bonds	9,034,400	1,000	94	94½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	52	53¼
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10.000,000	100	92½	92¾
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500.000	25	.	..
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	60	65
Bonds, 5's	3,556,000	.	90	93
Wilmington, Del.	500,000	50	180	182

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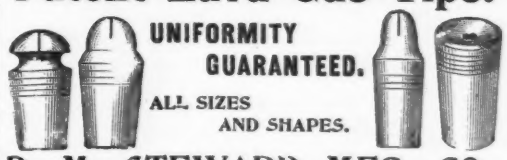

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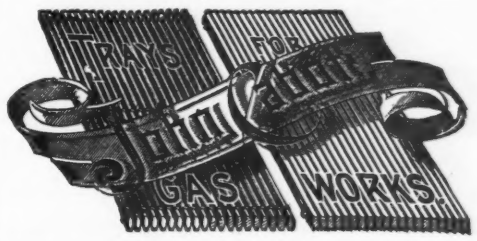

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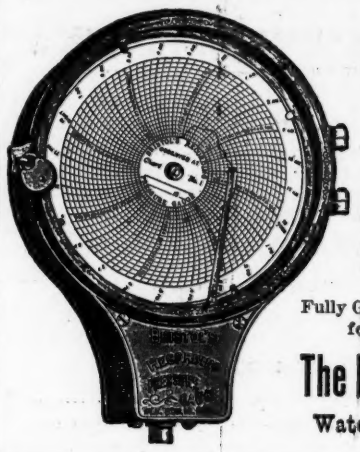

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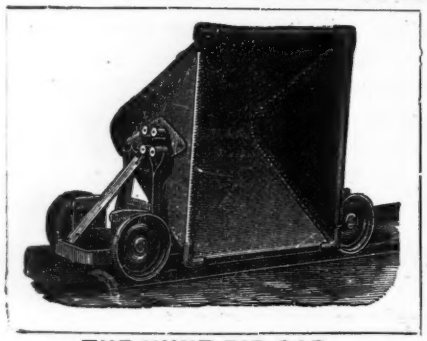

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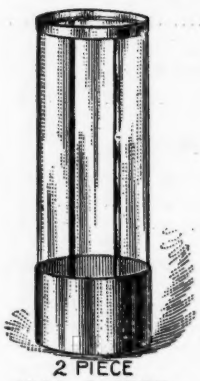

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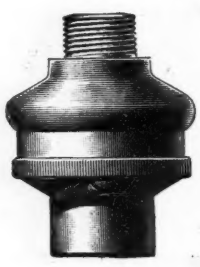

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PROSPECTUS.

THE object of the **Gas Exposition** is to bring together a collection of gas apparatus and appliances of every description, for the two-fold purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years. In submitting the plan of the Exposition to those who may feel an interest in the project, the management would call the attention of manufacturers of supplies of every description, entering into the manufacture of gas, to the great benefits which similar affairs have conferred on the industries of Great Britain, Germany and France, in which countries the exhibitions of gas appliances are held with recurring frequency. The creation of a healthy public sentiment in favor of gas is one of the first aims of large numbers of foreign gas companies.

MADISON SQUARE GARDEN.

In the selection of New York for the inauguration of an enterprise of this character, it is believed that no mistake has been made. In this city the Madison Square Garden is looked upon as one of the great show places of the metropolis; it contains within its walls the requisite space for the proper display of an almost unlimited amount of product, without which an affair of this kind cannot hope for the stamp of public approval—hence the selection of this great building for the inauguration of the gas industries exposition during the two weeks beginning January 25, 1897.

The greater New York contains a resident population of 3,000,000 people. Within a radius of 50 miles of Madison Square Garden live 4,500,000 people; reliable statistics show that an average of fully 100,000 strangers visit New York every day in the year. Thus it will be seen that the gas exposition will draw from a population of fully 6,000,000. In this connection it ma be stated that every effort will be put forth that ingenuity can devise to thoroughly advertise the exposition, and create a desire in the minds of the public to come to the show; and once within its portals the dazzling brilliancy there abounding, coupled with the many attractive and instructive exhibits, will cause the visitor to wish to come again.

It is expected that cooking demonstrations will be a feature of the exposition. The lecture and concert hall, situated conveniently near the great amphitheater, in which the exposition is to take place, affords seating room for 1,200 to 1,400 people. The most experienced and talented ladies obtainable will be selected for this feature of the affair, which must prove one of the show's greatest attractions; not only for the housewives who may be attracted to it, but for gas managers, who will thus have an opportunity to study the advantages these gas cooking demonstrations offer as one of the means at hand for the education of people in the uses of gas.

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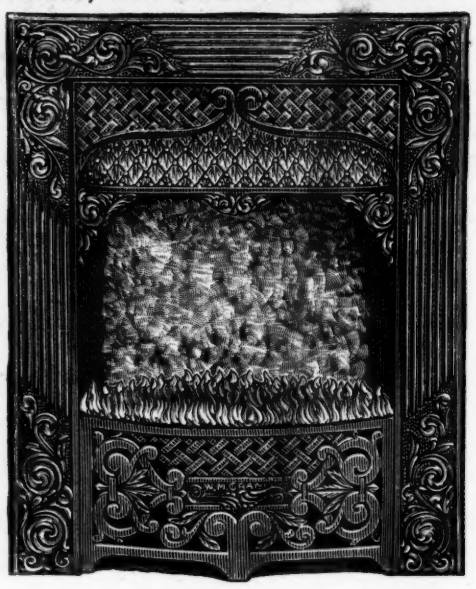

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On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York

WELSBACH LIGHT COMPANY.
vs.
A. LIEBES.
} IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

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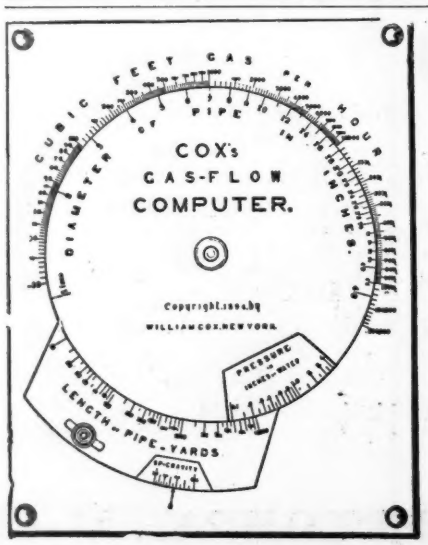

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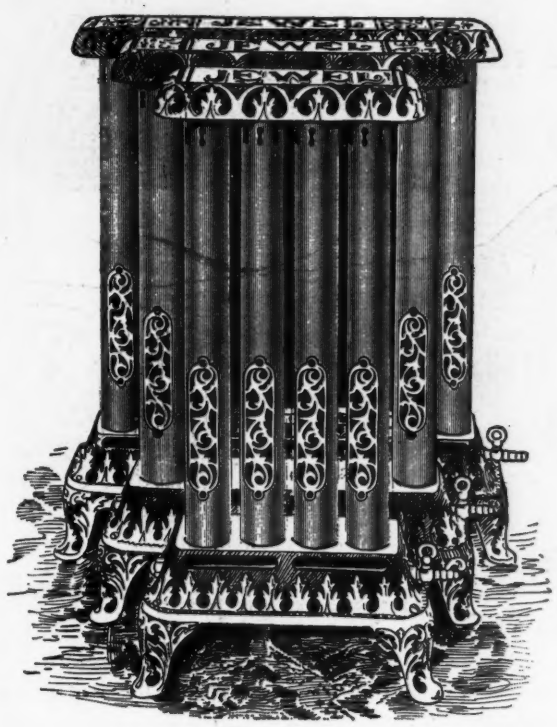

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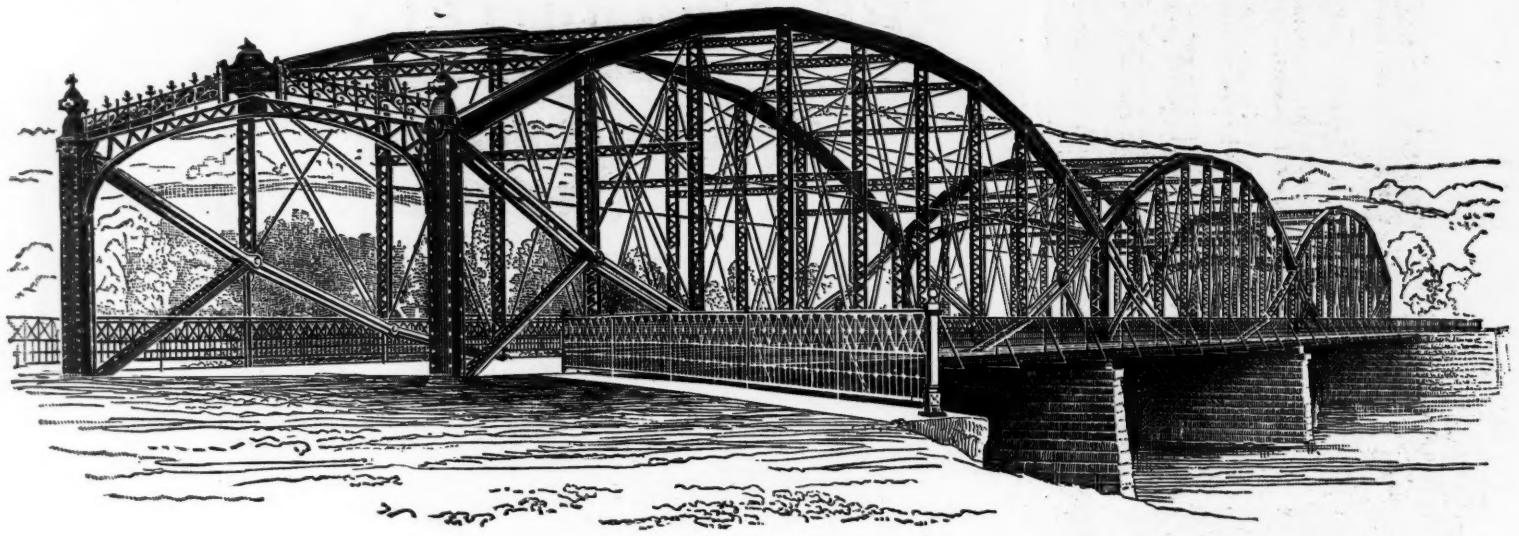

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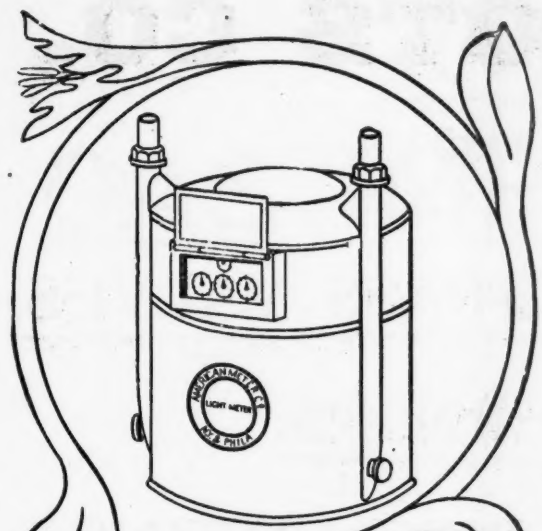

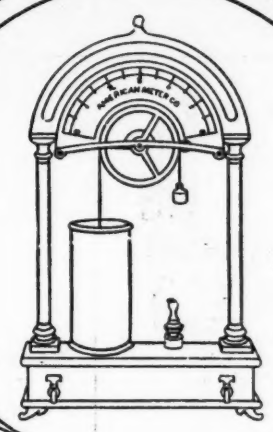

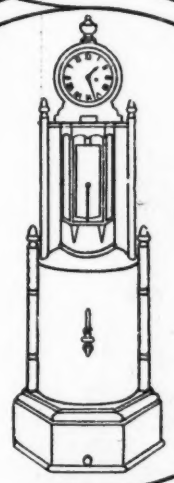

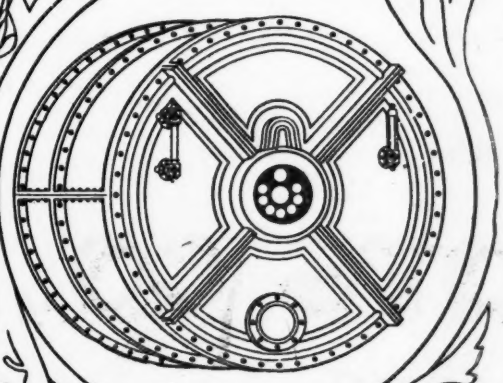

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SAN FRANCISCO.

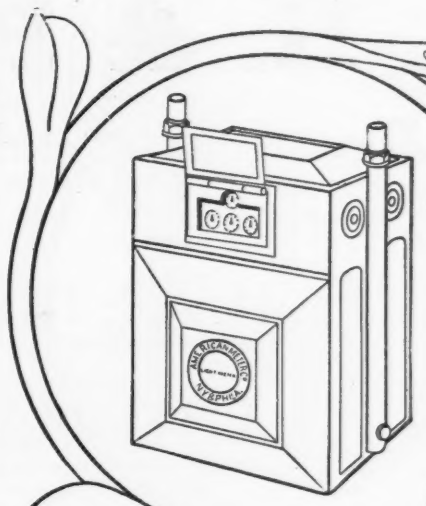
PUBLIC LIGHTING TABLE.

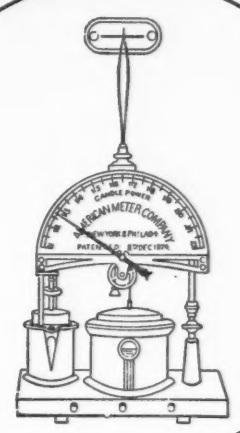
DECEMBER, 1896.

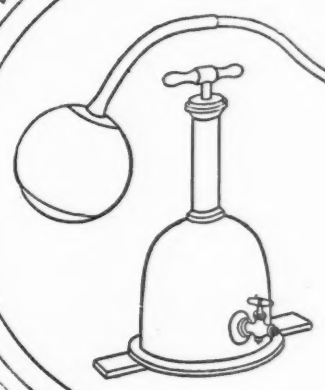
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	5.00 PM	6.10 AM	4.20	6.10
Wed.	2	5.00	6.10	4.20	6.10
Thu.	3	5 00	6.10	4.20	6.15
Fri.	4	5.00 NM	6.10	4.20	6.15
Sat.	5	5.00	6 10	4.20	6.15
Sun.	6	5.00	6.10	4.20	6 15
Mon.	7	5.00	6.10	4.20	6.15
Tue.	8	5.00	6.10	4.20	6.15
Wed.	9	9.00	6.10	4.20	6.15
Thu.	10	10.00	6.10	4.20	6.20
Fri.	11	11.00 FQ	6.10	4.20	6.20
Sat.	12	12.00	6.10	4.20	6.20
Sun.	13	1.00 AM	6.20	4.20	6.20
Mon.	14	2.00	6.20	4.20	6.20
Tue.	15	3.00	6.20	4.20	6.20
Wed	16	4.10	6.20	4.20	6.20
Thu.	17	5 10	6.20	4.20	6.20
Fri.	18	No L.	No L.	4.20	6.20
Sat.	19	No L. FM	No L.	4.20	6.20
Sun	20	No L.	No L.	4.20	6.20
Mon.	21	5.10 PM	7.00 PM	4.20	6.20
Tue.	22	5.10	8.10	4.20	6 20
Wed.	23	5.10	9.20	4.20	6.20
Thu.	24	5.10	10.30	4.20	6 25
Fri.	25	5.10	11.40	4.20	6.25
Sat.	26	5.10 LQ	12.50 AM	4.20	6.25
Sun.	27	5.10	2.00	4.20	6 25
Mon.	28	5.10	3.20	4.20	6.25
Tue.	29	5.10	4.30	4.20	6.25
Wed.	30	5.10	6.20	4.20	6.25
Thu.	31	5.10	6.20	4.20	6.25

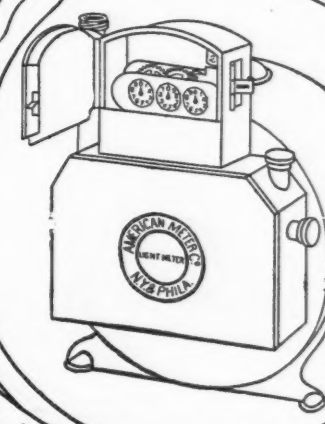
TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00









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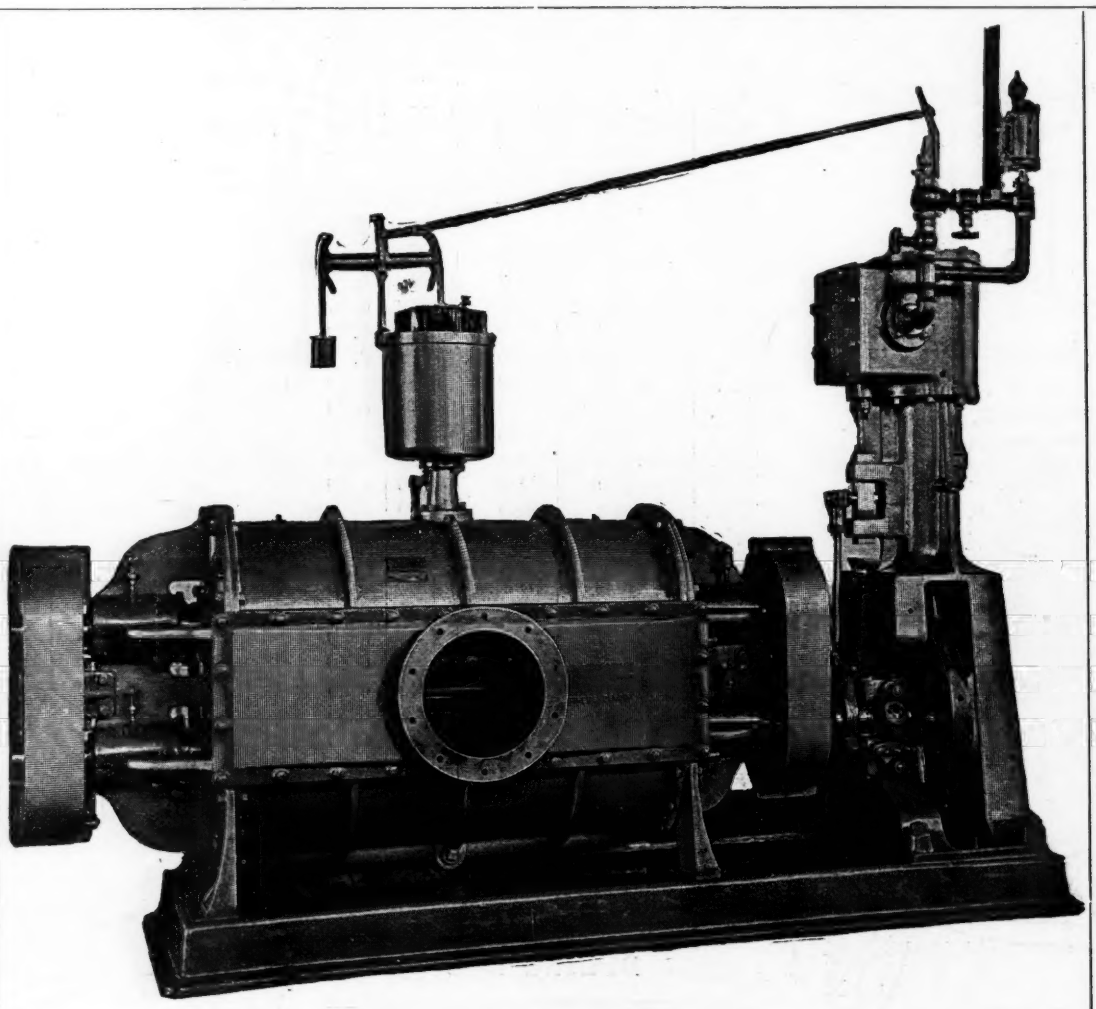

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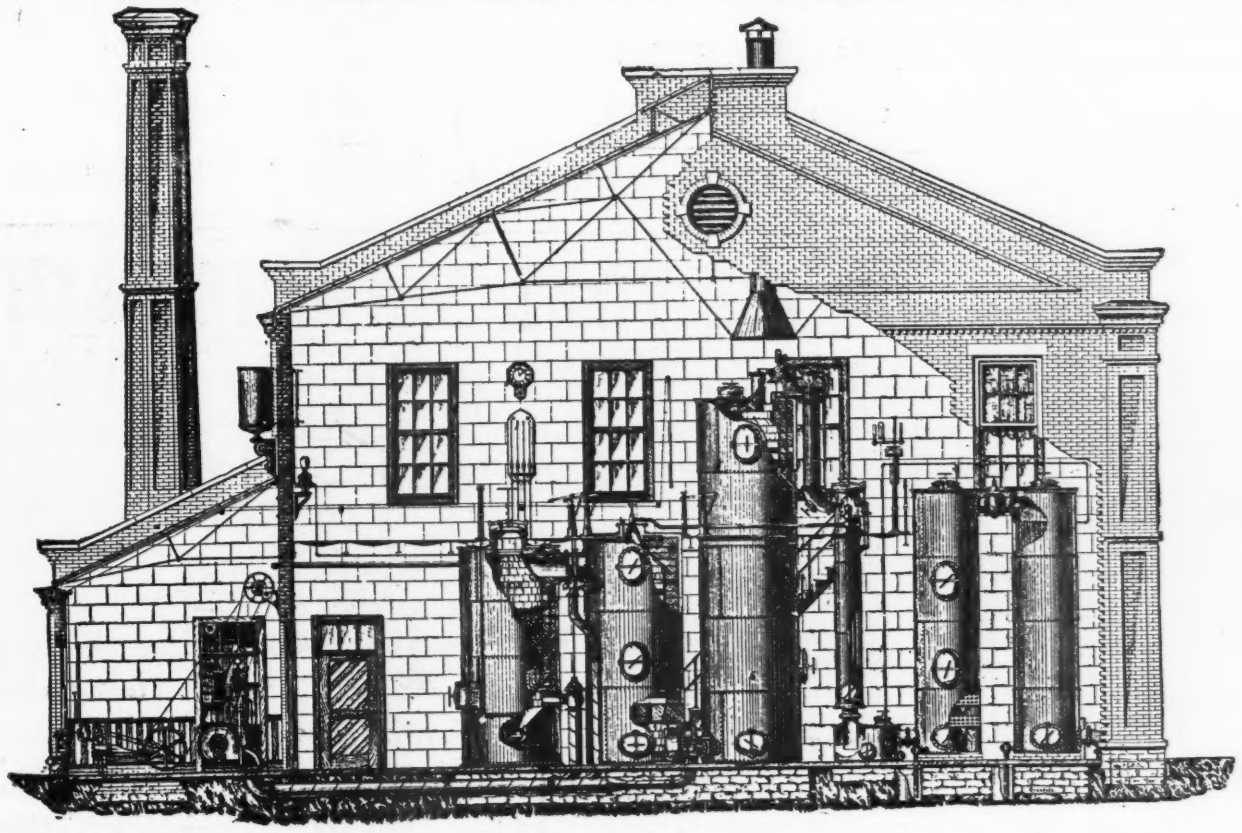

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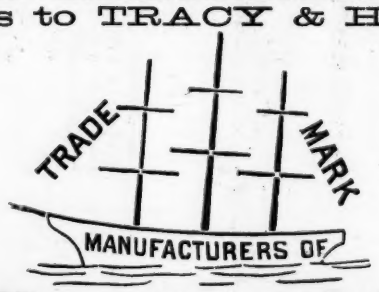

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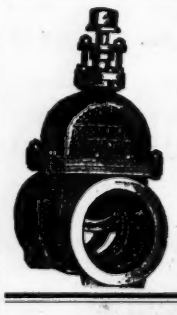

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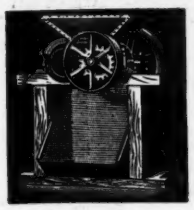

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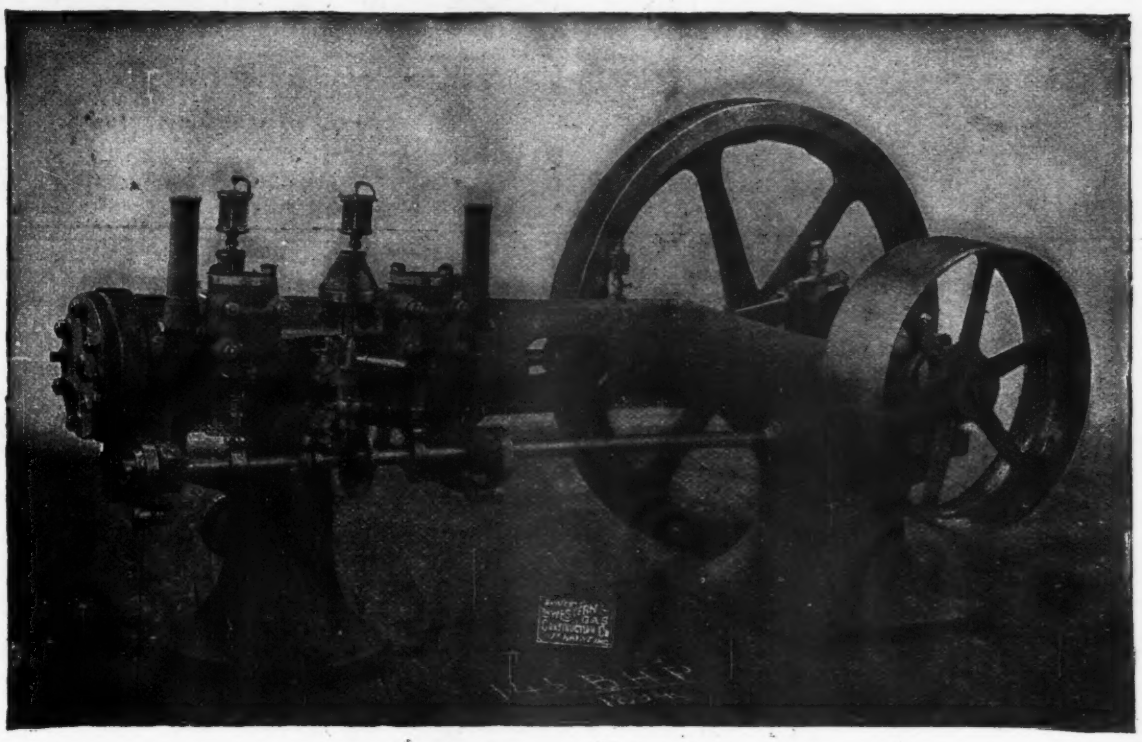

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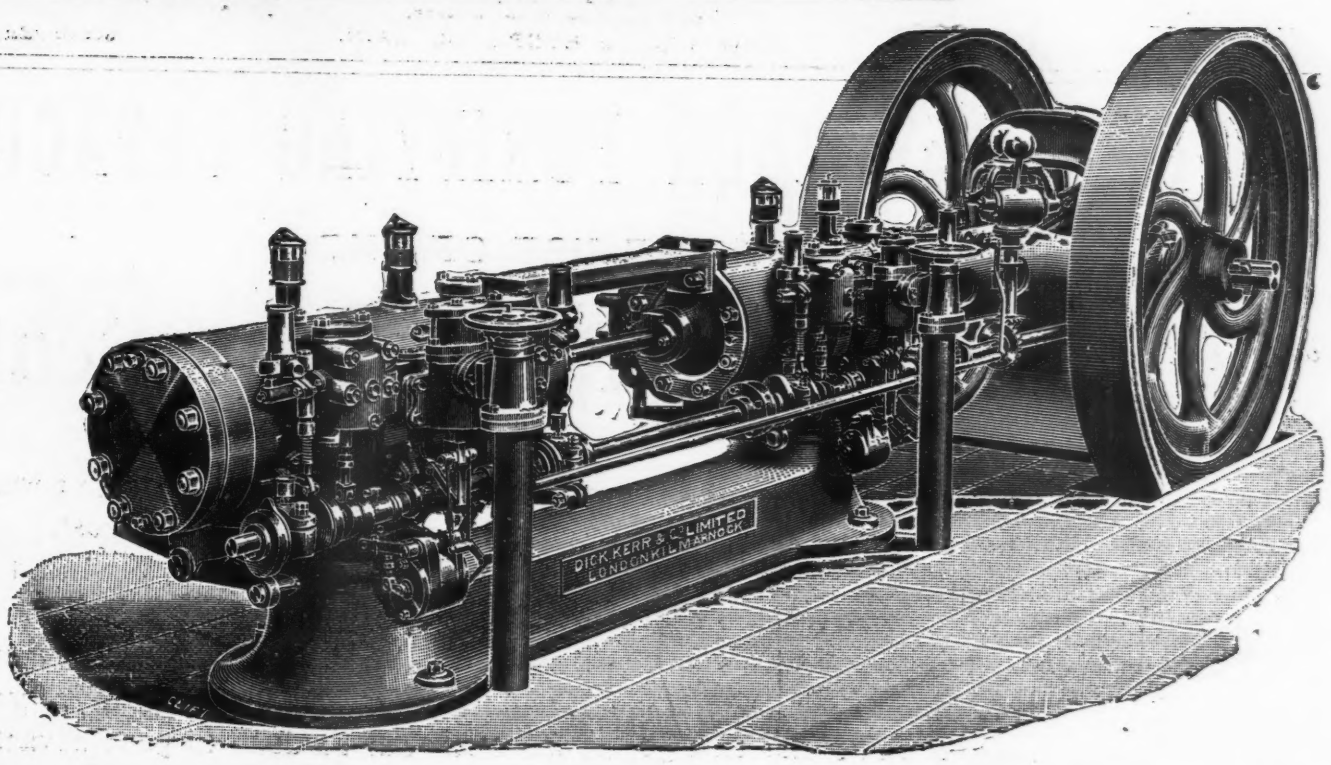

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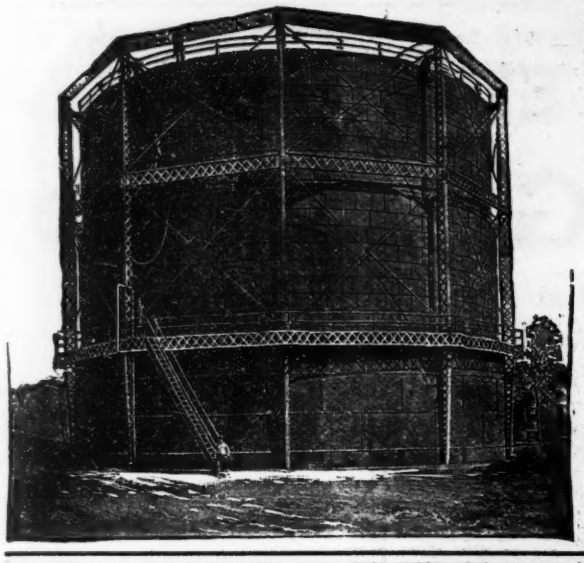

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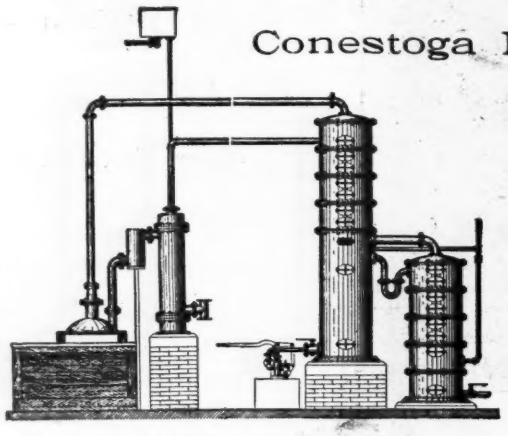

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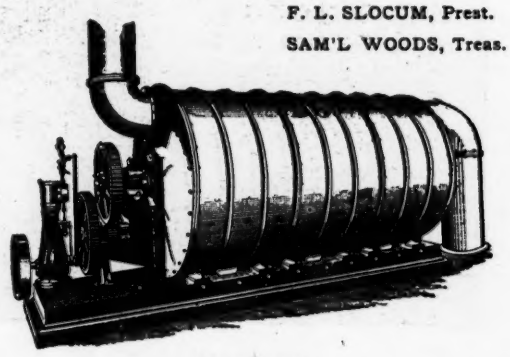

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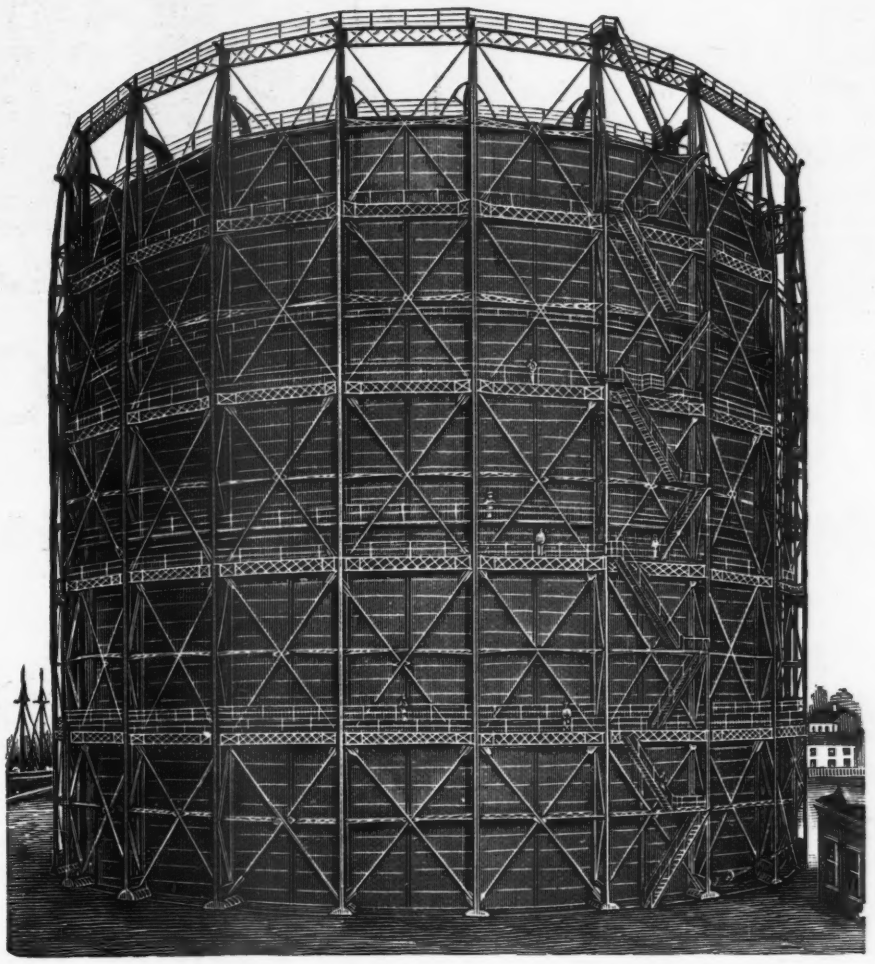

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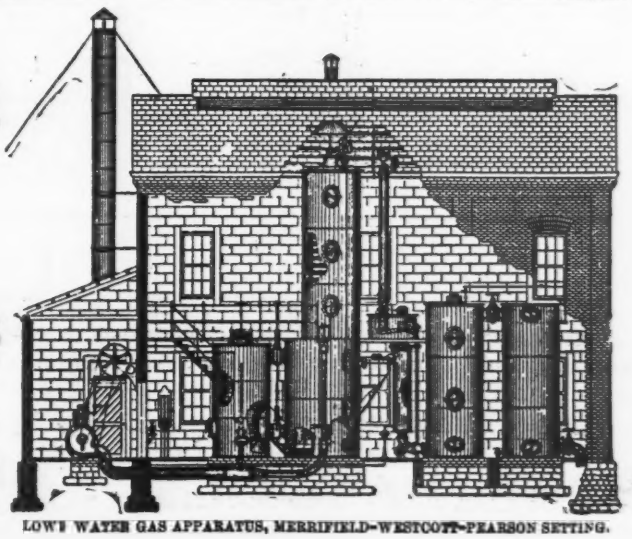

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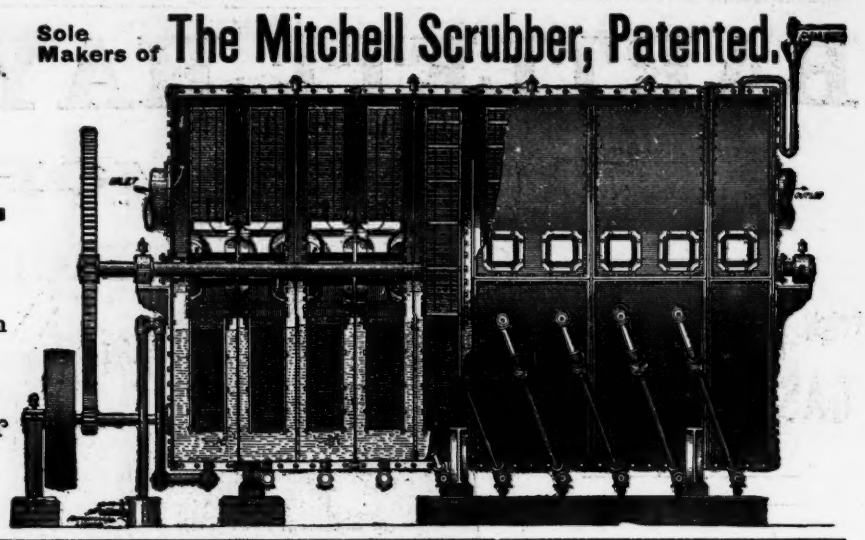

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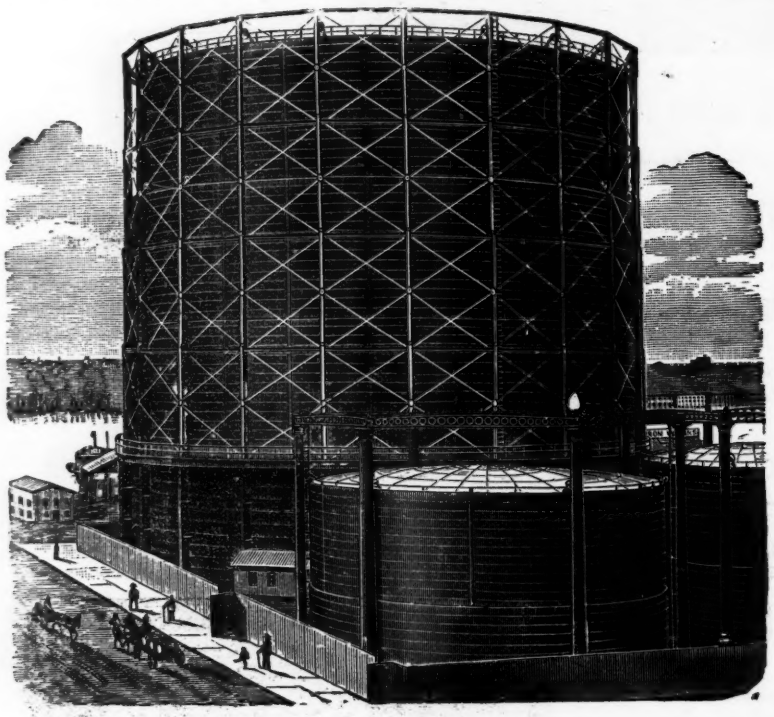

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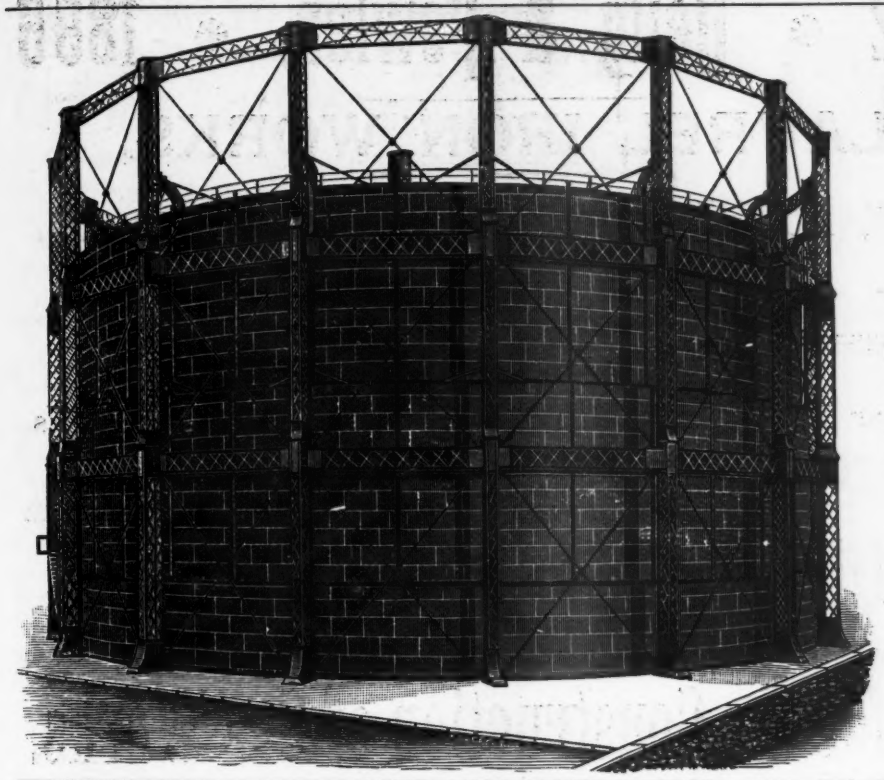

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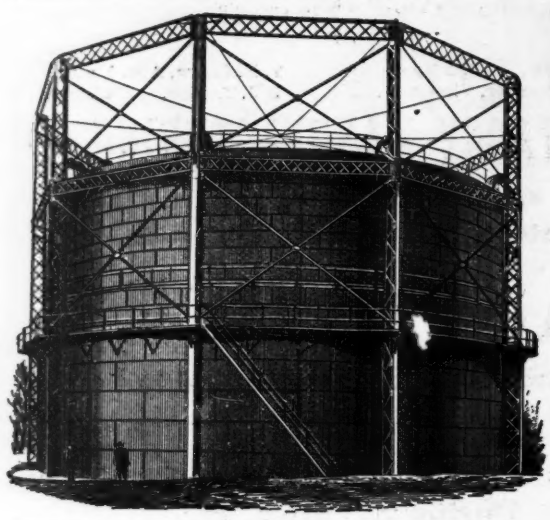

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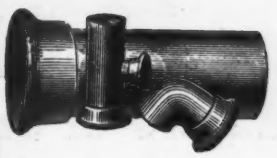

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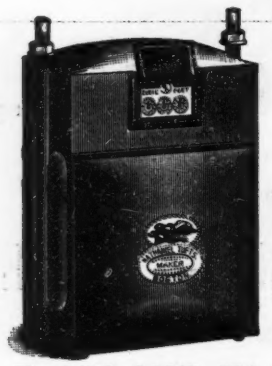

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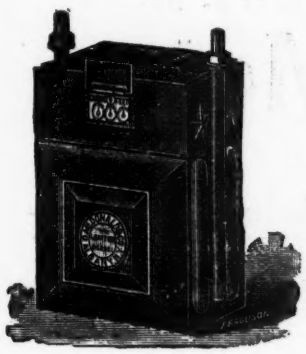

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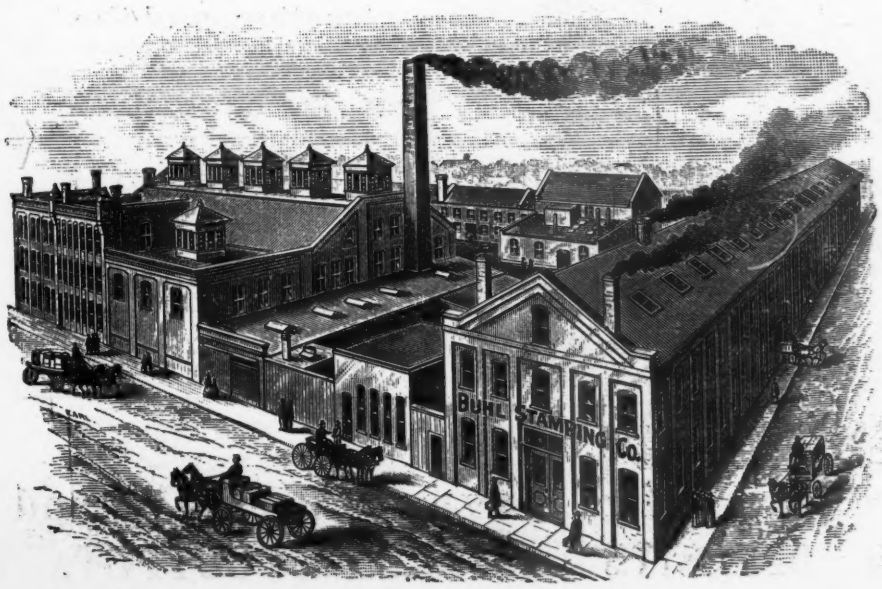

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